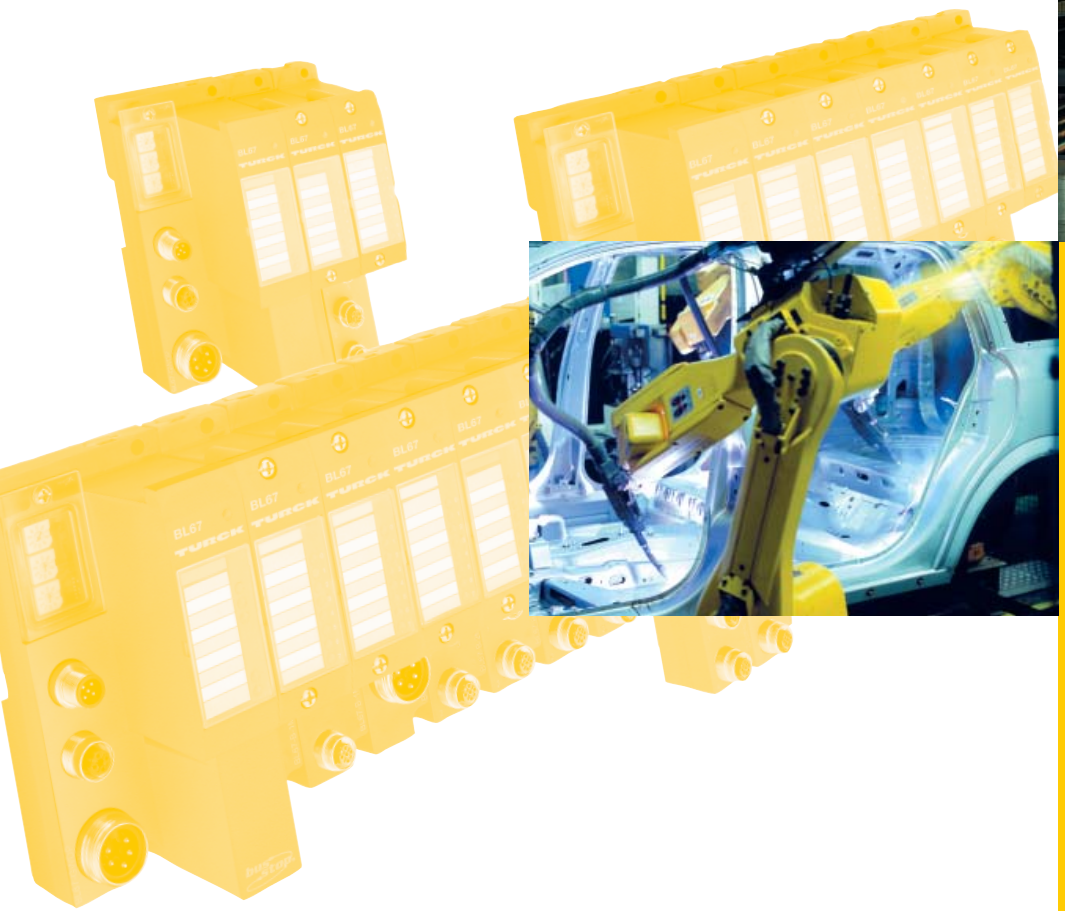
TURCK

Industrial
Automation

BL67 –

USER MANUAL FOR ETHERNET/IP



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Edition 09/2011

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Subject to alterations without notice

Warning!
Before commencing the installation

- Disconnect the power supply of the device.
- Ensure that devices cannot be accidentally restarted.
- Verify isolation from the supply.
- Earth and short circuit.
- Cover or enclose neighboring units that are live.
- Follow the engineering instructions of the device concerned.
- Only suitably qualified personnel in accordance with EN 50 110-1/-2 (VDE 0 105 Part 100) may work on this device/system.
- Before installation and before touching the device ensure that you are free of electrostatic charge.
- The functional earth (FE) must be connected to the protective earth (PE) or to the potential equalization. The system installer is responsible for implementing this connection.
- Connecting cables and signal lines should be installed so that inductive or capacitive interference do not impair the automation functions.
- Install automation devices and related operating elements in such a way that they are well protected against unintentional operation.
- Suitable safety hardware and software measures should be implemented for the I/O interface so that a line or wire breakage on the signal side does not result in undefined states in the automation devices.
- Ensure a reliable electrical isolation of the low voltage for the 24 volt supply. Only use power supply units complying with IEC 60 364-4-41 (VDE 0 100 Part 410) or HD 384.4.41 S2.
- Deviations of the mains voltage from the rated value must not exceed the tolerance limits given in the specifications, otherwise this may cause malfunction and dangerous operation.
- Emergency stop devices complying with IEC/EN 60 204-1 must be effective in all operating modes of the automation devices. Unlatching the emergency-stop devices must not cause restart.
- Devices that are designed for mounting in housings or control cabinets must only be operated and controlled after they have been installed with the housing closed. Desktop or portable units must only be operated and controlled in enclosed housings.
- Measures should be taken to ensure the proper restart of programs interrupted after a voltage dip or failure. This should not cause dangerous operating states even for a short time. If necessary, emergency-stop devices should be implemented.
- Wherever faults in the automation system may cause damage to persons or property, external measures must be implemented to ensure a safe operating state in the event of a fault or malfunction (for example, by means of separate limit switches, mechanical interlocks etc.).
- The electrical installation must be carried out in accordance with the relevant regulations (e. g. with regard to cable cross sections, fuses, PE).
- All work relating to transport, installation, commissioning and maintenance must only be carried out by qualified personnel. (IEC 60 364 and HD 384 and national work safety regulations).
- All shrouds and doors must be kept closed during operation.

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1.1 Documentation concept

This manual contains information about the BL67 Ethernet gateway with EtherNet/IP.

The following chapters contain a short BL67 system description, a description of the field bus system Ethernet, exact information about function and structure of the BL67 EtherNet/IP gateway as well as all bus specific information concerning the connection to automation devices, the maximum system extension etc.

The bus-independent I/O-modules for BL67 as well as all further fieldbus-independent chapters like mounting, labelling etc. are described in a separate manual.

- BL67 I/O-modules (TURCK-Documentation-No.: German D300572/ English D300529)

Furthermore, the manual mentioned above contains a short description of the project planning and diagnostics software for TURCK I/O-systems, the engineering software I/O-ASSISTANT.

1.2 General information

Attention

Please read this section carefully. Safety aspects cannot be left to chance when dealing with electrical equipment.

This manual contains all necessary information about the prescibed use of the TURCK BL67 gateways for Ethernet.
It has been specially conceived for personnel with the necessary qualifications.

1.2.1 Prescribed use

Danger

The devices described in this manual must be used only in applications prescribed in this manual or in the respective technical descriptions, and only with certified components and devices from third party manufacturers.

Appropriate transport, storage, deployment and mounting as well as careful operating and thorough maintenance guarantee the trouble-free and safe operation of these devices.

1.2.2 Notes concerning planning /installation of this product

Danger

All respective safety measures and accident protection guidelines must be considered carefully and without exception.

1.3 Description of symbols used

Danger

This sign can be found next to all notes that indicate a source of hazards. This can refer to danger to personnel or damage to the system (hardware and software) and to the facility.

This sign means for the operator: work with extreme caution.

Attention

This sign can be found next to all notes that indicate a potential hazard.

This can refer to possible danger to personnel and damages to the system (hardware and software) and to the facility.

Note

This sign can be found next to all general notes that supply important information about one or more operating steps. These specific notes are intended to make operation easier and avoid unnecessary work due to incorrect operation.

1.4 List of revisions

In comparison to the previous manual edition, the following changes/ revisions have been made:

Table 1: List of revisions

Chapter	Subject/ Description	new	changed	deleted
4	Status and Control word of the gateway (page 4-23)		X	
5	Assembly Object, Mapping of process data (page 5-13)		X	
	RFID-A support, Process Data Class (VSC102) (page 5-30)			X
	RFID-S module class (VSC124) (page 5-85)	X		

Note

The publication of this manual renders all previous editions invalid.

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2.5 The basic concept

BL67 is a modular IP67 I/O-system for use in industrial automation. It connects the sensors and actuators in the field to the higher-level master.

BL67 offers modules for practically all applications:

- Digital input and output modules
- Analog input and output modules
- Technology modules (RS232 interface,...)

A complete BL67 station counts as **one** station on the bus and therefore occupies **one** fieldbus address in any given fieldbus structure. A BL67 station consists of a gateway, power distribution modules and I/O-modules.

The connection to the relevant fieldbus is made via the bus-specific gateway, which is responsible for the communication between the BL67 station and the other fieldbus stations.

The communication within the BL67 station between the gateway and the individual BL67 modules is realized via an internal module bus.

Note

The gateway is the only fieldbus-dependent module on a BL67 station. All other BL67 modules are not dependent on the fieldbus used.

2.5.1 Flexibility

A BL67 station can contain modules in any combination, which means it is possible to adapt the system to practically all applications in automated industries.

2.5.2 Convenient handling

All BL67 modules, with the exception of the gateway, consist of a base module and an electronic module.

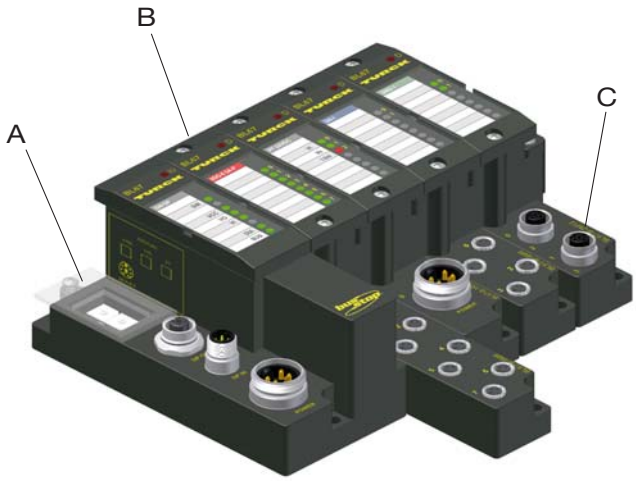
The gateway and the base modules are snapped onto a mounting rail or are directly mounted onto a mounting plate. The electronic modules are plugged onto the appropriate base modules.

After disconnection of the load, the electronic modules can be plugged or pulled when the station is being commissioned or for maintenance purposes, without having to disconnect the field wiring from the base modules.

2.6 BL67 components

Figure 1:
BL67 station

A *gateway*
B*electronic module*
C*base module*



2.6.1 Gateways

The gateway connects the fieldbus to the I/O-modules. It is responsible for handling the entire process data and generates diagnostic information for the higher-level master and the software tool I/O-ASSISTANT.

Figure 2:
BL67 gateway

2.6.2 Electronic modules

Electronic modules contain the functions of the BL67 modules (Power Feeding modules, digital and analog input/output modules, technology modules).

Electronic modules are plugged onto the base modules and are not directly connected to the wiring. They can be plugged or pulled when the station is being commissioned or for maintenance purposes, without having to disconnect the field wiring from the base modules.

Figure 3: electronic module

Power feeding modules

Power Feeding modules distribute the required 24 V DC field voltage to the I/O-modules. They are necessary for building groups of modules with different potentials within a BL67 station, or if the rated supply voltage for the outputs cannot be guaranteed.

Power Feeding modules are potentially isolated from the gateway, the adjoining power supply module and the I/O-modules to the left side.

Note

For detailed information about the individual BL67 I/O components, please refer to the chapters 2 to 8 of the manual "BL67- I/O-modules" (TURCK Documentation-No.: German D300572; English: D300529).

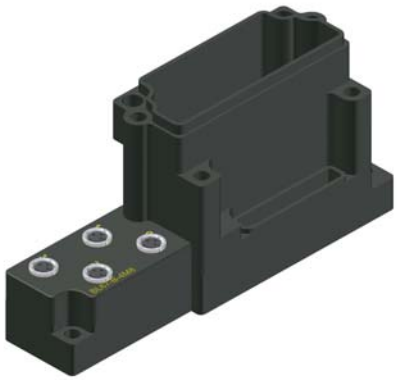
2.6.3 Base modules

The field wiring is connected to the base modules.

These are available in the following connection variations:

- 1 x M12, 2 x M12, 2 x M12-P, 4 x M12, 4 x M12-P
- 4 x M8, 8 x M8
- 1 x M12-8
- 1 × M23, 1 x M23-19
- 1 x 7/8" (for Power Feeding Module)

Figure 4: example of a base module



2.6.4 End plate

An end plate on the right-hand side physically completes the BL67 station.

It protects the module bus connections of the last base module in a station and guarantees the protection class IP67.

Figure 5: end plate

3 EtherNet/IP

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3.1 System description

Ethernet Industrial Protocol (EtherNet/IP) is a communication system for industrial applications.

It is used to exchange time-critical application information between industrial devices such as simple I/O devices (sensors/actuators) or even complex control devices (robots, programmable logic controllers, etc.).

EtherNet/IP is an open network because it uses:

- IEEE 802.3 Physical and Data Link standard
- Ethernet TCP/IP protocol suite (Transmission Control Protocol/Internet Protocol), the Ethernet industry standard.
- Common Industrial Protocol (CIP), the protocol that provides real-time I/O messaging and information/peer-to-peer messaging. ControlNet and DeviceNet networks also use CIP.

Note

For further infomation about CIP and EtherNet/IP™, please contact also the user organization ODVA (www.odva.org).

IP (Internet Protocol)

The Internet Protocol is a connection-free transport protocol. Since the protocol does not use acknowledgement messages, telegrams can get lost. Therefore it is not suitable for safe data transfer. The main functions of the internet protocol are the addressing of hosts and the fragmentation of data packages.

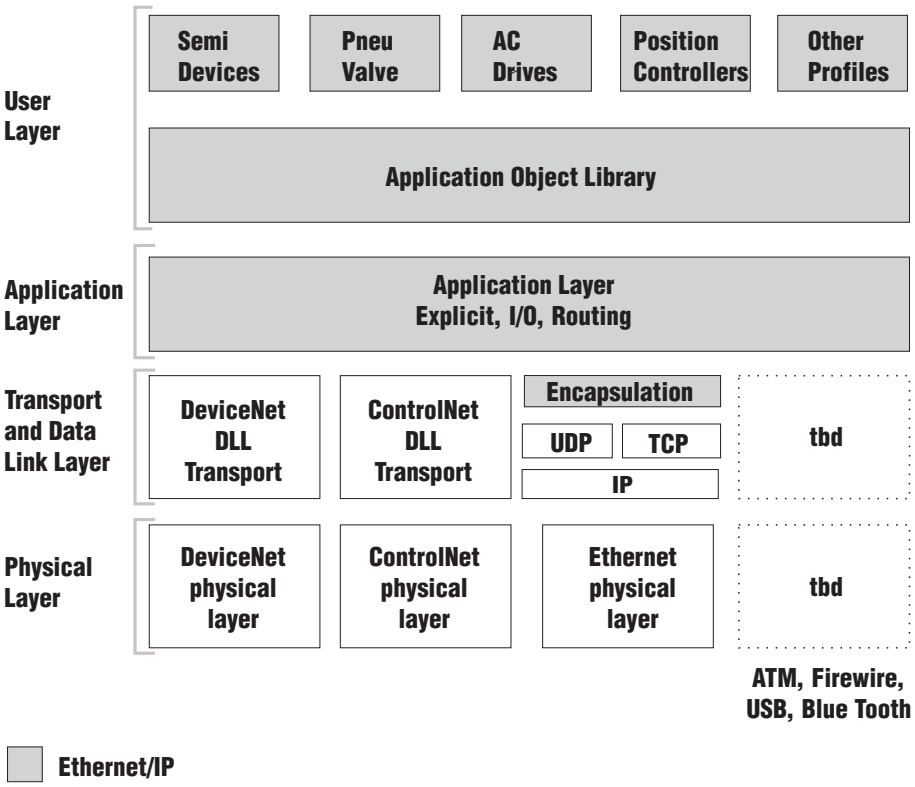
TCP (Transmission Control Protocol)

The Transmission Control Protocol (TCP) is a connection-oriented transport protocol and is based on the Internet Protocol. A safe and error-free data transport can be guaranteed by means of certain error diagnostic mechanisms. For example, the acknowledgement and time monitoring of telegrams.

UDP/IP (User Datagram Protocol)

UDP/IP provides the fast, efficient data transport necessary for real-time data exchange. To make EtherNet/IP successful, CIP has been added on top of TCP/UDP/IP to provide a common application layer.

Figure 6: EtherNet/IP in OSI 7 layer model



3.1.1 Network-topology

EtherNet/IP network uses an active star topology in which groups of devices are connected point-to-point to a switch.

Products with both transmission speeds (10 and 100 Mbit/s) can be used in the same network and most Ethernet switches will negotiate the speed automatically.

Transmission media

For communication via Ethernet, different transmission media can be used:

- coaxial cable (10Base5)
- optical fibre (10BaseF)
- twisted two-wire cable (10BaseT) with shielding (STP) or without shielding (UTP)

3.1.2 Addressing on EtherNet/IP

Ethernet MAC-ID

The Ethernet MAC-ID is a 6-byte-value which serves to identify an Ethernet device. The MAC-ID is determined for each device by the IEEE (Institute of Electrical and Electronics Engineers, New York).

The first 3 bytes of the MAC-ID contain a manufacturer identifier (Turck: 00:07:46:xx:xx:xx). The last 3 bytes can be chosen freely by the manufacturer for each device and contain a serial number.

The MAC-ID can be read from the module using the software tool "I/O-ASSISTANT".

IP address

Each Ethernet-host receives its own IP address. In addition, the node knows its netmask and the IP address of the default gateway.

The IP address is a 4-byte-value which contains the address of the network to which the node is connected as well as the host address in the network.

The IP address of the BL67-GW-EN-IP gateway is predefined as follows:

IP address: 192.168.1.xxx

netmask: 255.255.255.0

gateway: 192.168.1.001

The netmask shows which part of the IP address defines the network as well as the network class, and which part of the IP address defines the single node in the network.

In the example mentioned above, the first 3 bytes of the IP address define the network. They contain the subnet-ID 192.168.1.
The last byte of the IP address defines the node's address within the network.

Note

In order to build communication between a PC and an Ethernet-module, both have to be nodes on the same network.

If necessary, the nodes' network addresses have to be adapted one to another. Please read Chapter 5, ''Changing the IP address of a PC/ network interface card'', Page 5-5.

3.1.3 Network classes

The available networks are divided into the different network classes A, B, and C.

Figure 7: Network classes

Class	Network addresses	Bytes for net address	Bytes for host address	No. of possible networks/ hosts
A	1.xxx.xxx.xxx-126.xxx.xxx.xxx	1	3	126/ 2^{24}
B	128.0.xxx.xxx -191.255.xxx.xxx	2	2	2^{14}/ 2^{16}
C	192.0.0.xxx - 223.255.255.xxx	3	1	2^{21}/ 256

According to their predefined address 192.168.1.xxx BL67 gateways are nodes on a Class C network.

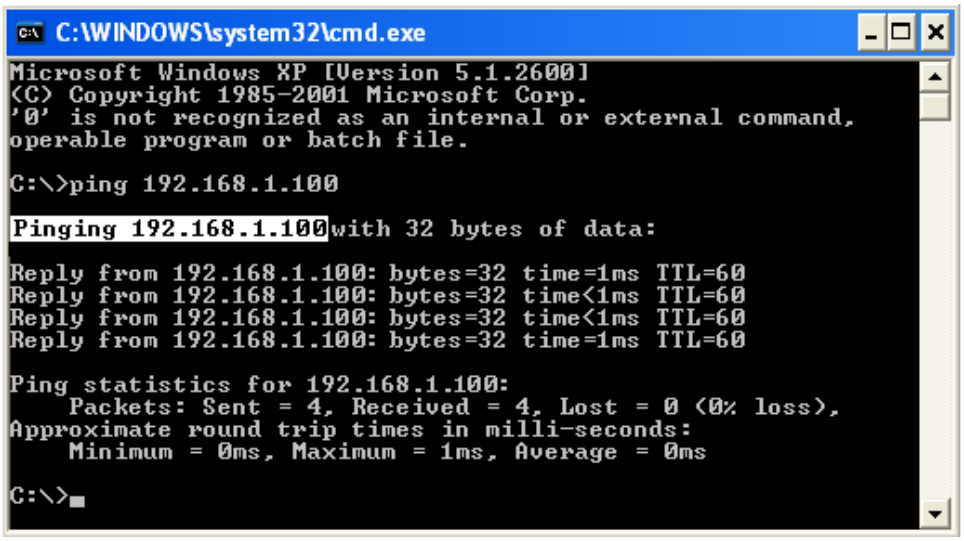
3.1.4 Checking the communication via "ping-signals"

You can check the communication between nodes in a network using ping-signals in the DOS-prompt of your PC.

For that purpose, enter the command "ping" and the IP address of the network node to be checked.

If the node answers the ping-signal, it is ready for communication and takes part in the data transfer.

Figure 8: ping-signal


C:\WINDOWS\system32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.
'0' is not recognized as an internal or external command,
operable program or batch file.
C:\>ping 192.168.1.100
Pinging 192.168.1.100with 32 bytes of data:
Reply from 192.168.1.100: bytes=32 time=1ms TTL=60
Reply from 192.168.1.100: bytes=32 time<1ms TTL=60
Reply from 192.168.1.100: bytes=32 time<1ms TTL=60
Reply from 192.168.1.100: bytes=32 time=1ms TTL=60
Ping statistics for 192.168.1.100:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 1ms, Average = 0ms
C:\>

3.1.5 ARP (Address Resolution Protocol)

In each TCP/IP-capable computer, ARP serves to clearly assign the worldwide unique hardware addresses (MAC-IDs) to the single IP addresses of the network nodes via internal tables.

Using ARP in the DOS-prompt, every node in a network can be clearly identified via its MAC-ID.

- Write a ping command for the respective station/ IP address: (example: "x:\\ping 192.168.1.100").
- Via the command "x:\\arp -a", the MAC-ID (00-07-46-ff-60-13) for this IP address is determined. This MAC-ID clearly identifies the network node.

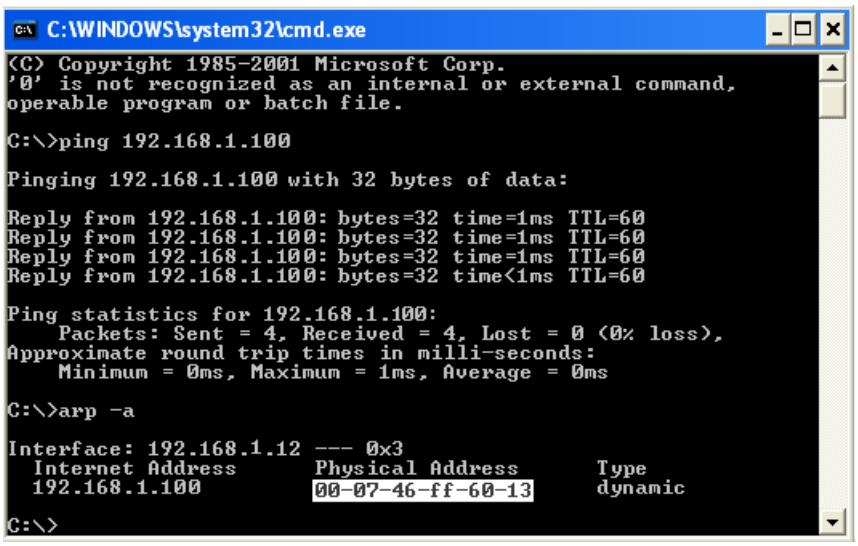


Figure 9: Determination of the MAC-ID of a BL67 module via ARP

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4.1 General

This chapter contains the general technical description of the BL67 gateway for EtherNet/IP.

This chapter describes: the technical data, the connection possibilities, the addressing of the gateway etc.

4.2 Function

The gateway for EtherNet/IP is the connection between the BL67 I/O-modules and the EtherNet/IP-network.

The gateway is a communication adapter according to CIP specification that handles the entire process data traffic between the I/O-level and the fieldbus and generates diagnostic information for higher-level nodes and the software tool I/O-ASSISTANT.

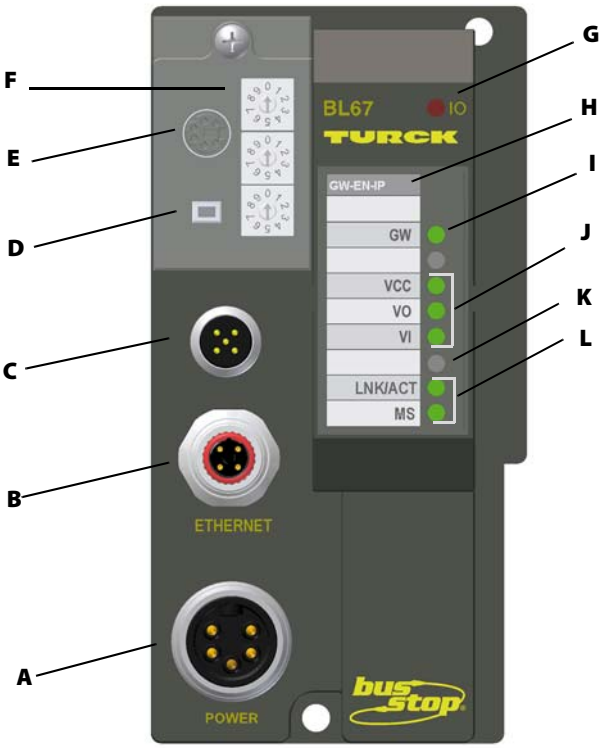
Note

A description of a possible DeviceNet-Master-function of EtherNet/IP gateways can be found in a separate manual (D301118) which can be downloaded from the TURCK homepage www.turck.com.

4.3 Technical data

Figure 10: BL67-GW-EN-IP

A*power supply*
B*Ethernet*
C*BL Remote (see manual D301118)*
D*SET-button*
E*service-interface*
F*rotary coding switches*
G*module bus LED*
H*designation*
I*status LED*
J*LEDs for supply voltage monitoring*
K*n.c.*
L*Ethernet LEDs*



4.3.1 Gateway structure

The BL67 gateway has the following structure:

Figure 11: Gateway structure

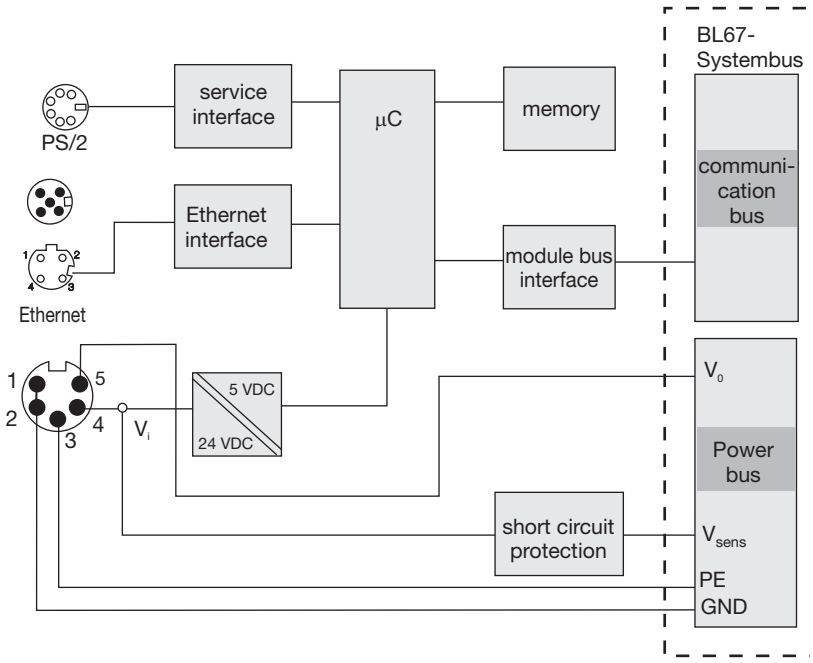


Table 2: Technical data Ethernet gateway

Supply voltage		
Demands on the voltage supply acc. to EN 61131-2		
System supply V_I (U_B)	24 VDC	used to generate the galvanically isolated module bus supply
permissible range	18 to 30 VDC	
Field supply V_O (U_L)	24 VDC	
permissible range	18 to 30 VDC	
I_{sys}	600 mA	current consumption CPU + module bus at maximum system extension
I_{MB}	max. 1,3 A	maximum output current of module bus supply
I_{VI}	max. 4 A	short-circuit and overload protection of the sensor supply from gateway or power feeding module
Isolation voltages		
U_{RS} (Ethernet/ service interface)	500 V AC	
U_{EN} (Ethernet/ module bus)	500 V DC	
U_{sys} (V_O/V_I to U_{sys})	1000 V DC	
Ambient conditions		
Ambient temperature		
– $t_{Ambient}$	0 to +55 °C /32 to 131 °F	
– t_{Store}	- 25 to +85 °C / - 13 to 185 °F	
Relative humidity	according to IEC 61131-2	
Climatic tests	according to IEC 61131-2	
Noxious gas	according to IEC 68068-42/43	
Resistance to vibration	according to IEC 61131-2	
Protection class	IP 67 according to IEC 60529	
Shock resistant	according to IEC 61131-2	
Topple and fall/ free fall	according to IEC 61131-2	
Emitted interference		
High-frequency, radiated	according to EN 55011, Class A	
Immunity to interference		

	Static electricity	according to IEC 61131-2
	Electromagnetic HF fields	according to IEC 61131-2
	Fast transients (Burst)	according to IEC 61131-2
	Conducted interferences induced by HF fields	according to IEC 61000-4-6 10 V Criteria A
A*I/O-line-length* ≤ *30 m*	High energy transients (Surge) **A** voltage supply	according to IEC 61000-4-5 0,5 kV CM, 12Ω/ 9 µF 0,5 kV DM, 2Ω/ 18 µF Criteria B
	Reliability	
	Operational life MTBF	min. 120000 h
	Electronics modules pull/plug cycles	20
	Dimensions	
	Width x length x height (mm/inch)	64,5 x 145,0 x 77,5 / 2,54 x 5,71 x 3,05

Danger

This device can cause radio disturbances in residential areas and in small industrial areas (residential, business and trading). In this case, the operator can be required to take appropriate measures to suppress the disturbance at his own cost.

4.4 Connection possibilities

4.4.1 Field bus connection

Ethernet-connector

The connection to Ethernet is realized via a 4-pole and D-coded female connector on the gateway according to CIP-standards.

Figure 12: M12-female connector

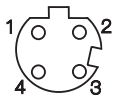


Table 3: Pin assignment of the Ethernet connector

Pin-No.		
1	TD+	Transmission Data +
2	RD+	Receive Data +
3	TD-	Transmission Data -
4	RD-	Receive Data -

DeviceNet-connector

For the description of a possible DeviceNet funciton of an EtherNet/IP gateway, please refer to the separate manual D301118.

4.4.2 Power Supply via 7/8" connector

The power supply is realized via a 7/8" male connector on the gateway.

Figure 13: power supply via 7/8" male connector

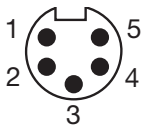


Table 4: Pin assignment of the 7/8" power supply connector

Pin-No.	Color	7/8"	Description
1	black	GND	
2	blue	GND	
3	green/yellow	PE	Protective earth
4	brown	V_I (U_B)	Feed-in of nominal voltage for input modules (sensor supply); also used for the generation of the system supply voltage
5	white	V_O (U_L)	Feed-in of nominal voltage for output modules (can be switched off separately)

4.4.3 Service interface connection

Two types of cables can be used to connect the service interface (female PS/2 connector) to a PC for the purpose of using
I/O-ASSISTANT (project planning and diagnostic software).

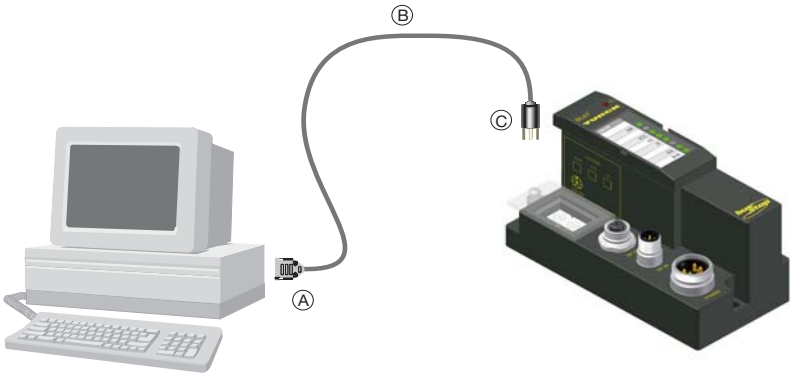
- special I/O-ASSISTANT-connection cable from TURCK
  (IOASSISTANT-ADAPTERKABEL-BL20/BL67; Ident-no.: 6827133)
- Commercially available PS/2 cable with adapter cable SUB-D/ PS/2

Note

Furthermore, in Ethernet/IP networks, the connection to the software I/O-ASSISTANT can also be realized directly via the Ethernet bus cable.

Connection with I/O-ASSISTANT-connection cable

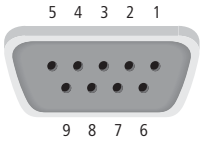
Figure 14: BL67-gateway connected to PC via special cable



The I/O-ASSISTANT-cables have a PS/2 male connector (connection for female connector on gateway) and a SUB-D female connector (connection for male connector on PC).

Figure 15: PS/2 male connector on the connection cable to the gateway (top view)

Figure 16: 9-pole SUB-D female connector on the cable for connecting to PC (top view)



Connection using commercially available cables

A further possibility to connect PC and BL67 gateway is to use a commercially available connection and adapter cable.

The connection shown in the following figure (PS2-male/ PS2-male) is a 6-wire 1:1 connection.

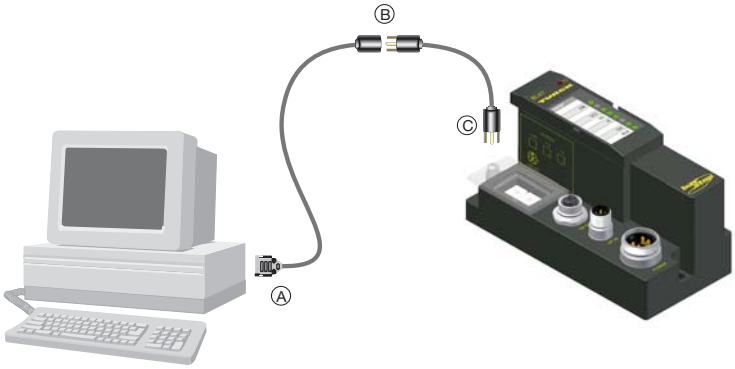


Figure 17: Connection between PC and BL67 gateway via commercially available cable

A *SUB-D-female*
B *PS/2-female <–> PS/2-male*
C *PS/2-male*

The following two cables are necessary:

- 1 x PS/2 cable (PS/2 male connector/PS/2 male connector) (commercially available keyboard extension cable)
- 1 x adapter cable (PS/2 female connector/SUB-D female connector) (commercially available extension cable for a PC mouse)

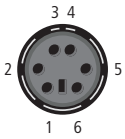


Figure 18: PS/2 female connector on the gateway (top view)

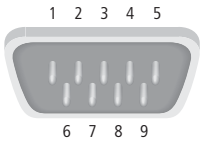


Figure 19: 9-pole SUB-D male connector on PC (top view)

Pin assignment

The table below shows the pin assignment when using a PS/2 cable and adapter:

Table 5: Pin assignment when using PS/2 cable and adapter

PS/2			**9-pole serial interface on PC**	
Pin-No.	Standard PS/2 male connector	BL67 gateway: PS/2 female connector	Pin-No.	Male connector
1	CLK	+5V (from gateway)	4, 6 **A**	DTR, DSR
2	GND	GND	5	GND
3	DATA	not connected	–	–
4	n.c. (DATA2)	TxD	2	RxD
5	+5V	/CtrlMode	7	RTS
6	n.c. (CLK2)	RxD	3	TxD

A *not supported by all adapter cables.*

4.5 Address setting for EtherNet/IP

Addressing the BL67 EtherNet/IP gateway can be done via different modes:

- rotary mode (manual addressing via rotary coding-switches)
- PGM mode (manual addressing via software)
- BootP mode, DHCP mode (automatic addressing via BootP/DHCP-server at the boot-up of the gateway).

Setting the address mode is done through the 3 rotary coding-switches on the gateway.

Note

It is not necessary to address the station's internal module bus.

Attention

The cover of the decimal rotary coding-switches must be closed by tightening the screw after use.

The seal in the cover must not be damaged or slipped.

The protection class IP67 can only be guaranteed when the cover is closed correctly.

4.5.1 LED-behavior

During it's start-up, the module waits for the address setting via the BootP-server. This is indicated by the red flashing "MS" LED. The LED begins to flash green as soon as the address setting via the server is completed. The station is ready for communication.

4.5.2 Default setting of the gateway

The gateway's default-settings are as follows:

IP address	192.168.001.254
subnet mask	255.255.255.000
default gateway	192.168.001.001

Note

The gateway can be reset by the user to these default settings at any time.
To reset the gateway, set the three coding-switches on the gateway to "000" followed by a power-on reset.

Figure 20: Decimal rotary coding-switches for the EtherNet/IP address setting

x 100

x 10

x 1

000: 192.168.1.254
1 - 254: static rotary
300: BootP
400: DHCP
500: PGM
600: PGM-DHCP

Attention

After every change of the address-mode, a voltage reset must be carried done.

4.5.3 Address setting via the rotary-mode

When using the rotary-mode, the last byte of the gateway's IP address can be set via the rotary coding-switches on the gateway.

Note

All other network settings are stored in the module's non-volatile EEPROM and can not be changed in the rotary-mode.

Addresses in the range from 1 to 254 can be allocated. Addresses 0 and 255 are reserved for broadcast messages in the subnet.

The following example shows the setting of address **173**.

Figure 21: Address setting

Attention

The settings carried out in the rotary-mode are not stored in the module's EEPROM. Thus, they will get lost in case of a subsequent address-assignment via a BootP/ DHCP or PGM.

Attention

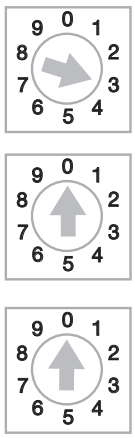
After changing the position of the rotary coding-switches, a voltage reset must be done to store the new address.

4.5.4 Address setting via BootP-mode

Address setting is carried out by a BootP-server in the network after the start-up of the gateway.

In order to activate the BootP-mode, the rotary coding-switches must be set to "300".

Figure 22: BootP-mode



Note

The IP address, as well as the default subnet mask assigned to the gateway by the BootP-server, are stored in the gateway's non-volatile memory.

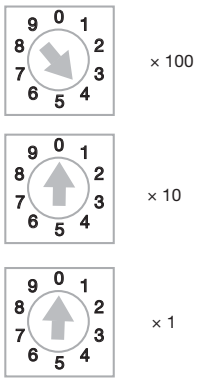
If the gateway is subsequently switched to rotary- or PGM-mode, the settings carried out via BootP (IP address, subnet mask, etc) will be read from the module's EEPROM.

4.5.5 Address setting via DHCP-mode

Address setting is carried out by a DHCP-server in the network after the start-up of the gateway.

In order to activate the DHCP-mode, the rotary coding-switches must be set to "400".

Figure 23: DHCP-Modus



Note

The IP address, as well as the default subnet mask assigned to the gateway by the DHCP-server, are stored in the gateway's non-volatile memory.

If the gateway is subsequently switched to rotary- or PGM-mode, the settings carried out via DHCP (IP address, subnet mask, etc) will read from the module's EEPROM.

DHCP supports three mechanisms for IP address allocation:

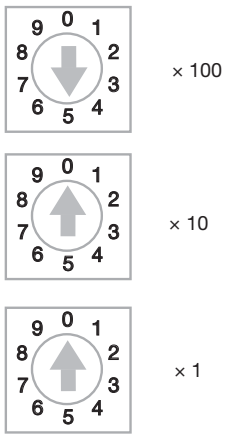
- In "automatic allocation", the DHCP-server assigns a permanent IP address to a client.
- In "dynamic allocation", DHCP assigns an IP address to a client for a limited period of time. After this time, or until the client explicitly relinquishes the address, the address can be re-assigned.
- In "manual allocation", a client's IP address is assigned by the network administrator, and DHCP is used simply to convey the assigned address to the client.

4.5.6 Address setting via PGM-mode

The PGM-mode enables access of the software I/O-ASSISTANT to the module's network settings.

In order to activate the PGM-mode, the rotary coding-switches must be set to "500".

Figure 24: PGM-mode



Note

In the PGM-mode, all network settings (IP address, subnet mask, etc.) are read from the module's internal EEPROM.

Settings carried out in the rotary-mode are stored in the module's non-volatile EEPROM.

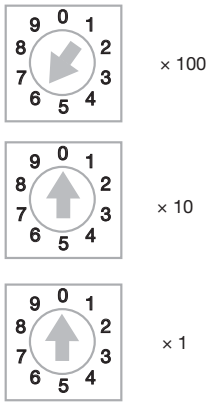
4.5.7 Address setting via PGM-DHCP

This mode operates exactly like the PGM-mode except that when the gateway is initially powered in this mode it will broadcast its MAC ID (similar to DHCP mode).

But, in contrast to the regular DHCP mode, the DHCP transmission on startup can be enabled/disabled via TCP Object attributes in EthernetIP.

In order to activate the PGM-DHCP-mode, the rotary coding-switches must be set to "600".

Figure 25: PGM-DHCP-mode



The I/O-ASSISTANT can also be used to set the IP Address in this mode.

This mode is the Out-of-the-Box mode fo the gateway and provides powerful and convenient Start-up features.

1 DHCP start up –if network contains DHCP server and/or automated configuration setup

2 Easy Rockwell BOOTP/DHCP-Server manipulation allowing TCP object access.

4.5.8 Address setting via the software I/O-ASSISTANT

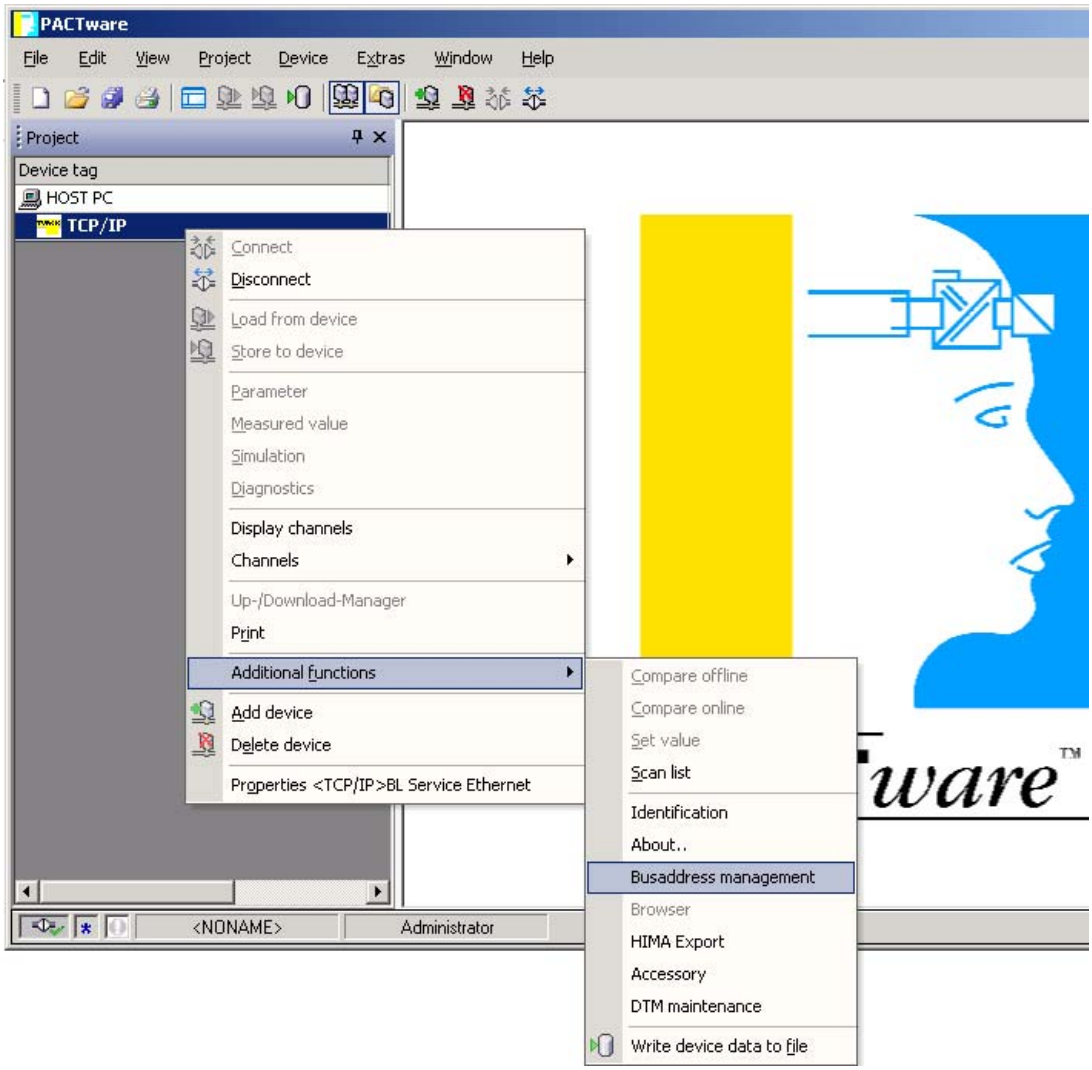
The software-tool I/O-ASSISTANT enables direct access to the Ethernet-network via the fieldbus cable.

Naturally, access to the single station via the service interface at the gateway is also possible.

The IP address, as well as the subnet mask of the TURCK Ethernet modules, can be changed according to the application by using the Busaddress Management function of the BL Service Ethernet interface in the I/O-ASSISTANT V3.

Changes in the network-configuration are only accepted in the PGM-mode and the PGM-DHCP mode (see Seite 4-15) of the gateway (see Seite 4-15).

Figure 26: Opening the Busaddress management



The network connected to the used network card can be scanned using the “Search“ function of the Busaddress management.

Figure 27: Search the network for nodes

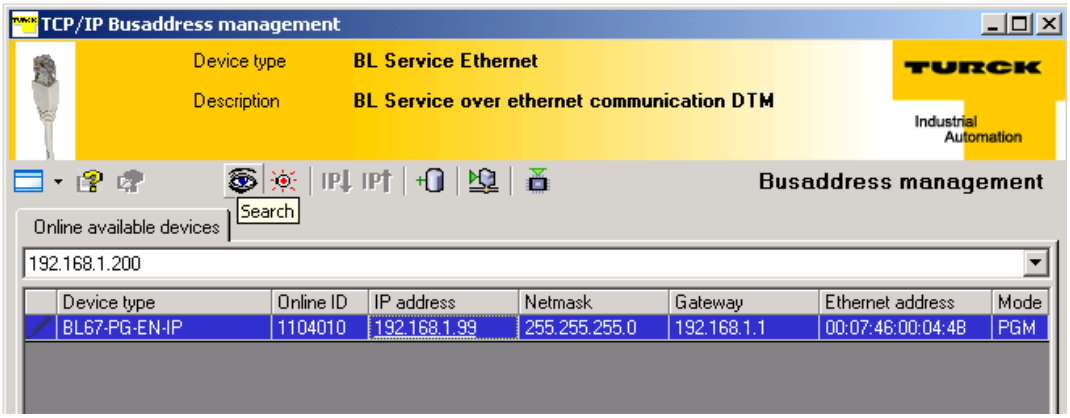
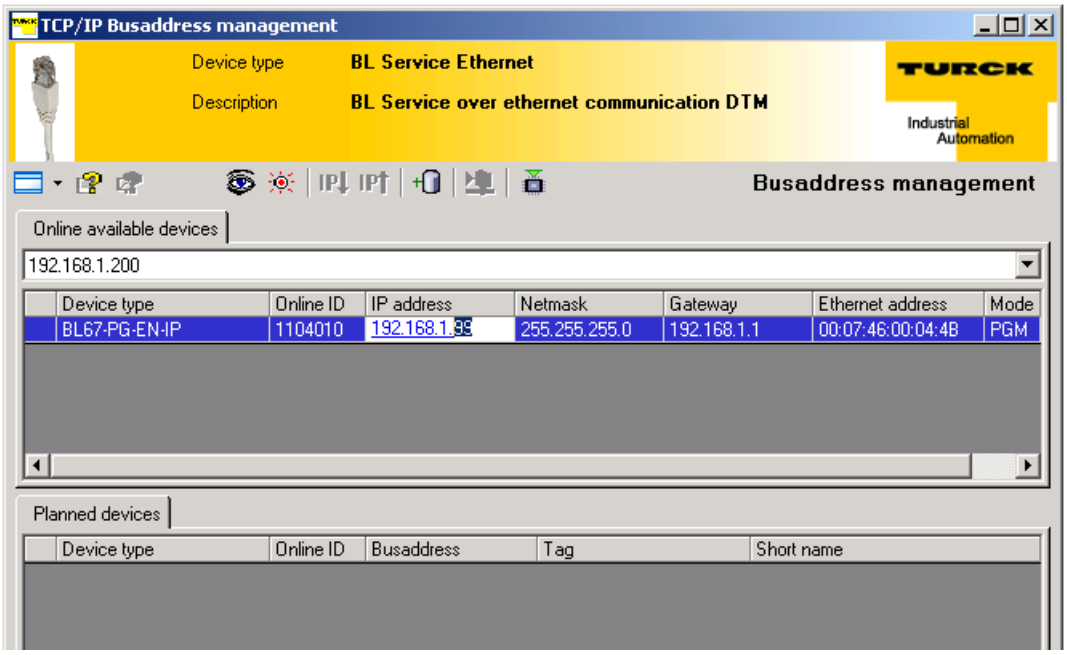


Figure 28: Change the IP address of a node



Attention

Please observe that, if the system integrated Windows-firewall is activated, difficulties may occur during the communication between the module and the Address-tool. The firewall may possibly inhibit the access of the tool on Ethernet.

Note

For further information about the Busaddress management in the software tool I/O-ASSISTANT, please read the online help delivered with the tool.

4.6 SET button

The Current Configuration of the BL67 EtherNet/IP station is saved as the Actual Configuration when the SET button on the gateway is pressed for approximately 10 seconds; it is also saved to the both the Temp-Required Configuration Memory and the Required Configuration Memory. The LED "GW" flashes.

In addition to that, pressing the SET button reads a possible BL Remote subnet connected to the gateway (see separate manual D301118).

4.7 Status indicators/ diagnostic messages gateway

The gateway sends the following diagnostic messages:

- undervoltage monitoring for system- and field supply,
- monitoring of the station status,
- monitoring of the communication via the internal module bus,
- monitoring of the communication to Ethernet
- monitoring of the gateway status

Diagnostic messages are displayed in different ways:

- via the LEDs
- via the gateway's status-word in the process data
- via the respective configuration software

4.7.1 Diagnostic messages via LEDs

Every BL67 gateway displays the following statuses via LEDs:

- 2 LEDs for module bus communication (module bus LEDs): **GW** and **IOs**
- 2 LEDs for the Ethernet communication (fieldbus-LEDs): **LNK/ACT** and **MS**.
- 3 LEDs for monitoring the voltage supply (system, $\mathbf{V_{CC}}$/ inputs, $\mathbf{V_i}$/ outputs, $\mathbf{V_o}$).
- 1 LED for the BL Remote-function of the gateway (see separate manual D301118)

Table 6: LED-displays

LED	Status	Meaning	Remedy
GW	Off	CPU not supplied.	
	Green	Firmware active, gateway ready to operate and transmit	-
	Green, flashing, 1 Hz	Firmware not active.	If LED "**IOs**" red → Firmware download necessary
	Green, flashing, 4 Hz	Firmware active, gateway hardware defect.	Replace the gateway.
	Red	Controller is not ready, VCC level is not within the required range → possible reasons: – too many modules connected to the gateway – short circuit in connected module – hardware error in gateway	– Check wiring at the gateway and the voltage supply. – Dismount modules – Replace the gateway.

Table 6: LED-displays

LED	Status	Meaning	Remedy
IO	Off	CPU not supplied.	– Check the voltage supply at the gateway.
	Green	Module bus is running, the configured module bus station corresponds to the physically connected station, communication is active.	-
	Green, flashing 1 Hz	Station is in the I/O-ASSISTANT Force Mode.	– Deactivate the I/O-ASSISTANT Force Mode.
	Green, flashing 4Hz	Maximum number of modules at the gateway is exceeded.	– Check the number of modules connected to the gateway, dismount modules
	Red	Controller is not ready, V_{CC} level is not within the required range → possible reasons: – too many modules connected to the gateway – short circuit in connected module – hardware error in – gateway	– Check wiring at the gateway and the voltage supply. – Dismount modules – Replace the gateway.
	Red flashing, 1 Hz	Non-adaptable modification of the physically connected station.	– Compare the planned BL67 station with the physical station. – Check the physical station for defective or incorrectly fitted electronics modules.
	Red flashing, 4 Hz	no module bus communication	– At least one module has to be plugged and has to be able to communicate with the gateway.
	Red/green flashing, 1 Hz	Adaptable modification of the physically connected station; data transfer possible	– Check the physical station for pulled or new but not planned modules.
V_{cc}	Off	CPU not supplied	– Check the system supply at the gateway.
	Green	Module bus and CPU running	-
V_O	Off	No voltage supply.	Check the system supply at the gateway.
	Green	Output supply ok.	
	Green flashing, 1 Hz	Undervoltage V_O, system running	– Check the system supply at the gateway
	Green flashing, 4 Hz	Overvoltage V_O, system running	

Table 6: LED-displays

LED	Status	Meaning	Remedy
V_I	Off	No voltage supply.	– Check the wiring of the voltage supply at the gateway
	Green	sensor supply ok.	-
	Green, flashing, 1Hz	undervoltage V_I, system running	– Check the wiring of the voltage supply at the gateway
	Green, flashing, 4Hz	Overvoltage V_I, system running	
	Red	Short circuit or overload at sensor supply → sensor supply is switched off	– Automatic restart when debugging.
LNK/ ACT	Off	No Ethernet link	– Check the Ethernet-connection
	Green	Link, 100 Mbit/s	
	Green flashing	Ethernet Traffic 100 Mbit/s	
	Yellow	Link, 10 Mbit/s	
	Yellow, flashing	Ethernet Traffic 10 Mbit/s	
MS	Green	Displays an active CIP Class 1 I/O connection	
	Green, flashing	Gateway is ready for operation	
	Red	Gateway indicates error	
	Red, flashing	DHCP/BootP search of settings	

4.7.2 Diagnostic messages via the process data

Besides the evaluation of diagnostic data via Explicit Messages, BL67 for EtherNet/IP offers the possibility of mapping diagnostic data into the gateways' process data.

2 different forms of diagnostic data handling are provided:

- Summarized Diagnostics
- Scheduled Diagnostics

Summarized diagnostics

Note

The Summarized Diagnostics possibility is only implemented in gateways with Rev. ≥ 1.3.0.16.

The summarized diagnostic data mode will send back 1 bit for each slice within the station. This bit will be "0" if there are no diagnostic flags set on the slice. If there are any diagnostic events on the slice the bit will be set to "1".

Values:

0 = ok

1 = module sends diagnostics, wrong module or module pulled (acc. to VSC 100, Gateway Class, Attr. 116, Seite 5-26).

The diagnostic bits are placed at the end of the input data. The diagnostic data start WORD aligned (see Seite 5-15).

Scheduled diagnostics

Note

The Scheduled Diagnostics possibility is only implemented in gateways with Rev. ≥ 1.3.0.16.

The scheduled diagnostic data map is a time sliced module related data block, which holds diagnostic data of all modules with active diagnostics using a round robin mechanism.

This diagnostic "window" visualizes a specific module diagnostic data for approx. 125 ms and changes over to the next active diagnostics afterwards. This is done automatically by the gateway.

The data length for the scheduled diagnostics is set according to properties of the modules attached to the gateway.

Word	Byte	Data
0	0	Slot number of the module which sends the diagnostic data.
	1	State of the diagnostic message: bit 5 = 1: diagnostic active bit 6 = 1: wrong module bit 7 = 1: module pulled (acc. to VSC 100, Gateway Class, Attr. 116, Seite 5-26)
n		Module diagnostics from the module actually referenced by the round robin mechanism.

The scheduled diagnostic data is placed at the end of the input data and after the summarized diagnositic data (see Seite 5-15).

4.8 Status and Control word of the gateway

4.8.1 Status word

The gateways status word is mapped into the process data (see also Mapping of process data (page 5-13)) and contains common diagnostic messages such as:

- gateway errors
- module bus errors
- voltage errors
- configuration/ diagnostic warnings

Table 7: Status Word

Bit-No.	Meaning
15	"I/O Controller Error„The communication controller for the I/O-system is faulty.
14	"Force Mode Active Error" The Force Mode is activated.
13	reserved
12	
11	"I/O CfgModified Error“ The I/O-configuration has been changed and is now incompatible.
10	"I/O Communication Lost Error" No communication on the I/O module bus.
9	"U_{sys} too low" System supply voltage too low (< 18 VDC).
8	"U_{sys} too high" System supply voltage too high (> 30 VDC).
7	"U_L too low" Load voltage too low (< 18 VDC).
6	"U_L too high" Load voltage too high (> 30 VDC)
5	"I_{sys} too high" Overload of the system voltage supply.
4	reserved
3	"I/O CfgModified Warning"
2	reserved
1	
0	"I/O DiagActive Warning" At least one I/O-module sends active diagnostics.

It can also be accessed via the Gateway Class VSC 100, Object Instance 2, Gateway Instance, attribute 109 (0×6D) "STATUS REGISTER 2" (for detailed information, see STATUS REGISTER 2 (page 5-26).

4.8.2 Control word

The control word is mapped into the station‘s process data. At present, it is not used but reserved for further use (see also Mapping of process data (page 5-13).

4.9 Module specific diagnostic messages

Detailed module specific diagnostic messages can be read out from Gateway Class VSC 100, Object Instance 2, Gateway Instance, attribute 116 (0×74) MODULE DIAG SUMMARY.

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5.1 The EtherNet/IP Communications Profile

EtherNet/IP is based on a connection-oriented communication model. This means that it is only possible to exchange data via specified connections assigned to the devices.

Communication between the nodes in the EtherNet/IP network can be carried out either via I/O Messages or Explicit Messages.

5.1.1 I/O Messages

I/O Messages serve to exchange high priority process and application data over the network. Communication between the slaves in the EtherNet/IP network is carried out according to the Server/Client Model, which means a producing application transmits data to another or a number of consuming applications. It is quite possible that information is passed to a number of Application Objects in a single device.

Explicit Messages

Explicit Messages are used to transmit low-priority configuration data, general management data or diagnostic data between two specific devices. This is a point-to-point connection in a Server/Client System that requires a request from a client always to be confirmed by a response from the server.

Explicit messages, whether connected or unconnected, use the Message Router (for detailed information, read section "Message Router Request/Response Formats", page 5-8).

- Message Router Request
  Consists of a service code, path size value, a message router path and service data. An EPATH is used in the message router path to indicate the target object.
- Message Router Response
  Consists of a service field with the most significant bit set. This is an echo of the service code in the request message with the most significant bit set. A reserved byte follows the service code, which is followed by the General Status code.

5.1.2 Communications Profile of the BL67 EtherNet/IP gateway

The EtherNet/IP gateway behaves as an EtherNet/IP Server in the network; the scanner of the higher-level controller operates as a EtherNet/IP Client.

The following EtherNet/IP communications types are supported:

- Point to Point or Multicast
- Cyclic I/O Connection
- Unconnected (UCMM) Explicit Messaging
- Connected Explicit Messaging

Point to point

A connection that exists between two nodes only.

Multicast

A packet with a special destination address, which multiple nodes on the network may be willing to receive.

COS I/O Connection

COS (Change Of State) I/O Connections establish event-controlled connections. This means that the EtherNet/IP devices generate messages as soon as a change of status occurs.

Cyclic I/O Connection

Messages are triggered time-controlled in Cyclic I/O connections by means of a time generator.

UCMM

The EtherNet/IP gateway offers the option of establishing explicit messaging via the UCMM port (Unconnected Message Manager Port).

UCMM-based explicit messaging is normally used for random, non-periodic requests. It is not recommended for frequent messaging because the UCMM input queue in a product is typically limited to just a few messages. Once this limit is reached, subsequent requests are ignored and must be retried.

Connected Explcit messaging

CIP is a connection-based system. For most communications between nodes, a connection is used.

A connection is a path or a virtual circuit between two or more end points in a system. The purpose is to transfer data in the most efficient manner possible.

The Connection ID is a number that is associated with a communication relationship. Receiving nodes decode this key to know whether they must accept the data or not.

5.2 Classes and instances of the EtherNet/IP-gateway

5.2.1 EtherNet/IP Standard Classes

The BL67 gateway supports the following EtherNet/IP Standard Classes in accordance with the CIP specification.

Table 8: EtherNet/IP Standard Classes

Class Code	Object-Name	Description
01 (0×01)	Identity	The Identity Object is required on all devices and provides general information about the device. It enables clear and unambiguous identification of modules. Contains information such as manufacturer name, product type, ident number, revision number etc.
02 (0×02)	Message Router	The Message Router Object provides a messaging connection point through which a Client may address a service to any object class or instance residing in the physical device.
04 (0×04)	Assembly	The Assembly Object binds attributes of multiple objects, which allows data to or from each object to be sent or received over a single connection. Assembly objects can be used to bind input data or output data. The terms "input" and "output" are defined from the network's point of view. An input will produce data on the network and an output will consume data from the network.
06 (0×06)	Connection Manager	The Connection Manager Class allocates and manages the internal resources associated with both I/O and Explicit Messaging Connections. The specific instance generated by the Connection Manager Class is referred to as a Connection Instance or a Connection Object.
15 (0×0F)	Parameter Object	currently not supported
244 (0×F4)	Port Object	Provides a standard way of describing a device's ports.
245 (0×F5)	TCP/IP Interface Object	Contains the device TCP/IP-related configuration information.
246 (0×F6)	Ethernet Link Object	Contains link-specific counters and status information for an Ethernet 802.3 communications interface.

5.2.2 Identity Object

The following description of the Identity Object is taken from the CIP specification, Vol. 1, Rev. 2.1, by ODVA & ControlNet International Ltd. and adapted to BL67.

Class attributes

Table 9: Class attributes

Attr. No.	Attribute Name	Get/ Set	Type	Value
1 (0×01)	REVISION	G	UINT	1
2 (0×02)	MAX OBJECT INSTANCE	G	UINT	1
6 (0×06)	MAX CLASS ATTRIBUTE	G	UINT	7
7 (0×07)	MAX INSTANCE ATTRIBUTE	G	UINT	7

Instance attributes

Table 10: Instance attributes

Attr. No.	Attribute Name	Get/ Set	Type	Description
1 (0×01)	VENDOR	G	UINT	Contains the vendor ID, managed by the Open DeviceNet Vendor Association, Inc. (ODVA) and ControlNet International (CI): TURCK = 48
2 (0×02)	PRODUCT TYPE	G	UINT	Indicates the general type of product. Communications Adapter 12_{dez} = 0×0C
3 (0×03)	PRODUCT CODE	G	UINT	Identifies a particular product within a device type. Default: 27229
4 (0×04)	REVISION Major Minor	G	STRUCT OF: USINT USINT	Revision of the item the Identity Object is representing. 0x01 0x02
5 (0×05)	DEVICE STATUS	G	WORD	See Table 11: Device Status
6 (0×06)	SERIAL NUMBER	G	UDINT	Contains the ident-no. of the product (3 last bytes of the MAC-ID).
7 (0×07)	PRODUCT NAME LENGTH NAME	G	STRUCT OF USINT STRING [13]	BL67-GW-EN-IP

Device Status

Table 11: Device Status

Bit	Name	Definition
0 to 1	reserved	Default = 0
2	Configured	TRUE → The application of the device has been configured (≠ default-settings).
3	reserved	Default = 0
4 to 7	Extended Device Status	0011 = No I/O connections established 0110 = At least one I/O connection in run mode 0111 = At least one I/O connection established, all in idle mode All other settings = reserved
8 to 15	reserved	Default = 0

Common Services

Table 12: Common services

Service Code	Class	Instance	Service Name
01 (0x01)	yes	yes	Get_Attribute_All Returns a predefined listing of this objects attributes.
05 (0x05)	no	yes	Reset Starts the Reset service for the device.
14 (0x0E)	yes	yes	Get_Attribute_Single Returns the contents of a specified attribute.
16 (0x10)	no	no	Set_Attribute_Single Modifies a single attribute.

5.2.3 Message Router Object

This object provides a messaging connection point through which a Client may address a service to any object class or instance residing in the physical device.

The following description of the Message Router Object is taken from the CIP specification, Vol. 1, Rev. 2.1 by ODVA & ControlNet International Ltd. and adapted to BL67.

Class attributes

Table 13: Class attributes

Attr. No.	Attribute Name	Get/ Set	Type	Value
1 (0×01)	REVISION	G	UINT	1
4 (0×04)	OPTIONAL ATTRIBUTE NUMBER	G	UINT	0
5 (0×05)	OPTIONAL SERVICE NUMBER	G	UINT	0
6 (0×06)	MAX CLASS IDENTIFIER	G	UINT	7
7 (0×07)	MAX INSTANCE ATTRIBUTE	G	UINT	2

Instance attributes

Table 14: Instance attributes

Attr. No.	Attribute Name	Get/ Set	Type	Description
1 (0×01)	OBJECT LIST	G	STRUCT OF	Structure with an array of object class-codes supported by the device.
	NUMBER	G	UINT	Depending
	CLASSES	G	ARRAY of UINT	Number of the classes supported by the gateway.
2 (0×02)	MAX NUMBER OF CONNECTIONS	G	UINT	Count of the maximum number of connections supported.

Common Services

Table 15: Common services

Service Code	Class	Instance	Service Name
01 (0x01)	yes	yes	Get_Attribute_All
14 (0x0E)	yes	yes	Get_Attribute_Single

Message Router Request/Response Formats

- Message Router Request Format:

Table 16: Message Router Request

Parameter	Data Type	Description
Service	USINT	Service code of the request.
Request Path Size	USINT	Number of 16 bit words in the "Request Path".
Request Path	Padded EPATH	Array of bytes containing the information for the path of request (class ID, Instance ID, etc.) for this transaction.
Request Data	Array of octed	Additional service specific data to be delivered in the Explicit Messaging Request.

- Message Router Response Format:

Table 17: Message Router Request

Parameter	Data Type	Description
Reply Service	SINT	Reply service code.
General Status	USINT	General Status Code according to CIP specification. See Table 18: General Status Codes according to CIP spec.
Size of Additional Status	USINT	Number of 16 bit words in "Additional Status".
Additional Status	Array of USINT	Additional status.
Response Data	Array of octet	Response data from request or additional error data if an error was indicated in "General Status".

Table 18: General Status Codes according to CIP spec.

Status Code (hex)	Status Name	Description
00	Success	Service successfully performed by the object specified.
01	Connection failure	A connection related service failed along the connection path.
02	Resource unavailable	Resources needed for the object to perform the requested service were unavailable.
03	Invalid parameter value	See Status Code 0x20, which is the preferred value to use for this condition.
04	Path segment error	The path segment identifier or the segment syntax was not understood by the processing node. Path processing shall stop when a path segment error is encountered.
05	Path destination unknown	The path is referencing an object class, instance or structure element that is not known or is not contained in the processing node. Path processing shall stop when a path destination unknown error is encountered.
06	Partial transfer	Only part of the expected data was transferred.
07	Connection lost	The messaging connection was lost.
08	Service not supported	The requested service was not implemented or was not defined for this Object Class/Instance.
09	Invalid attribute value	Invalid attribute data detected.
0A	Attribute list error	An attribute in the Get_Attribute_List or Set_Attribute_List response has a non-zero status.
0B	Already in requested mode/state	The object is already in the mode/state being requested by the service.
0C	Object state conflict	The object cannot perform the requested service in its current mode/state.
0D	Object already exists	The requested instance of object to be created already exists.
0E	Attribute not settable	A request to modify a non-modifiable attribute was received.
0F	Privilege violation	A permission/privilege check failed.
10	Device state conflict	The device's current mode/state prohibits the execution of the requested service.
11	Reply data too large	The data to be transmitted in the response buffer is larger than the allocated response buffer.
12	Fragmentation of a primitive value	The service specified an operation that will fragment a primitive data value, i.e. half a REAL data type.
13	Not enough data	The service did not supply enough data to perform the specified operation.

Table 18: General Status Codes according to CIP spec.

Status Code (hex)	Status Name	Description
14	Attribute not supported	The attribute specified in the request is not supported.
15	Too much data	The service supplied more data than expected.
16	Object does not exist	The object specified does not exist in the device.
17	Service fragmentation sequence not in progress	The fragmentation sequence for this service is not currently active for this data.
18	No stored attribute data	The attribute data of this object was not saved prior to the requested service.
19	Store operation failure	The attribute data of this object was not saved due to a failure during the attempt.
1A	Routing failure, request packet too large	The service request packet was too large for transmission on a network in the path to the destination. The routing device was forced to abort the service.
1B	Routing failure, response packet too large	The service response packet was too large for transmission on a network in the path from the destination. The routing device was forced to abort the service.
1C	Missing attribute list entry data	The service did not supply an attribute in a list of attributes that was needed by the service to perform the requested behavior.
1D	Invalid attribute value list	The service is returning the list of attributes supplied with status information for those attributes that were invalid.
1E	Embedded service error	An embedded service resulted in an error.
1F	Vendor specific error	A vendor specific error has been encountered. The Additional Code Field of the Error Response defines the particular error encountered. Use of this General Error Code should only be performed when none of the Error Codes presented in this table or within an Object Class definition accurately reflect the error.
20	Invalid parameter	A parameter associated with the request was invalid. This code is used when a parameter does not meet the requirements of this specification and/or the requirements defined in an Application Object Specification.
21	Write-once value or medium already written	An attempt was made to write to a write-once medium (e.g. WORM drive, PROM) that, has already been written, or to modify a value that cannot be changed once established.
22	Invalid Reply Received	An invalid reply is received (e.g. reply service code does not match the request service code, or reply message is shorter than the minimum expected reply size). This status code can serve for other causes of invalid replies.

Table 18: General Status Codes according to CIP spec.

Status Code (hex)	Status Name	Description
23 to 24	Reserved by CIP for future extensions	
25	Key Failure in path	The Key Segment that was included as the first segment in the path does not match the destination module. The object specific status shall indicate which part of the key check failed.
26	Path Size Invalid	The size of the path which was sent with the Service Request is either not large enough to allow the Request to be routed to an object or too much routing data was included.
27	Unexpected attribute in list	An attempt was made to set an attribute that is not able to be set at this time.
28	Invalid Member ID	The Member ID specified in the request does not exist in the specified Class/Instance/Attribute
29	Member not settable	A request to modify a non-modifiable member was received
2A	Group 2 only server general failure	This error code may only be reported by DeviceNet Group 2 Only servers with 4K or less code space and only in place of Service not supported, Attribute not supported and Attribute not settable.
2B to CF	Reserved by CIP for future extensions	
D0 to FF	Reserved for Object Class and service errors	This range of error codes is to be used to indicate Object Class specific errors. Use of this range should only be performed when none of the Error Codes presented in this table accurately reflect the error that was encountered.

5.2.4 Assembly Object

Assembly Objects bind attributes of multiple objects to allow data to or from each object to be sent or received over a single connection.

The following description of the Assembly Object is taken from the CIP specification, Vol. 1, Rev. 2.1 by ODVA & ControlNet International Ltd. and adapted to BL67.

Class attributes

Table 19: Class attributes

Attr. No.	Attribute Name	Get/ Set	Type	Value
1 (0×01)	REVISION	G	UINT	2
2 (0×02)	MAX OBJECT INSTANCE	G	UINT	2

Instance attributes

Table 20: Instance attributes

Attr. No.	Attribute Name	Get/ Set	Type	Description
1 (0×01)	NUMBER OF MEMBERS IN LIST	G	UINT	0 (no dynamic)
2 (0×02)	MEMBER LIST	G	ARRAY of STRUCT UINT UINT Packed EPATH	Depends on Instance.
3 (0×03)	DATA	S	ARRAY OF BYTE	
4 (0×04)	SIZE	G	UINT Number of bytes in Attr. 3	256

Common Services

Table 21: Common services

Service Code	Class	Instance	Service Name
01 (0x01)	yes	yes	Get_Attribute_All
14 (0x0E)	no	yes	Get_Attribute_Single

Instance 101

Contains the station's input data (static length 256 bytes).

2 Bytes status information (see page 5-26)
+ process data

Instance 102

Contains the station's output data (static length 256 bytes).

2 Bytes Control data (mapped, but not defined)
+ process data

Instance 103 + Instance 104

In- and output assembly instances with variable assembly sizes. The assembly size is precalculated to support the stations I/O-configuration, RFID Command interface configuration, enabled diagnostics, etc.

- input assembly instance: 103
- output assembly instance: 104

The size of each assembly instance can be retrieved through the assembly object, instance 0x67, attribute: 0x04 and can vary between 2 and 496 bytes.

Mapping of process data

The process image of the BL67 gateway is depicted in WORD format (16 bit). The process data of successive modules of the same type, with process data of less than 1 word, are grouped together until 16 bits of process data is reached.

The process data is written in a new word when:

- 16-bit input data is reached and further input modules follow
- 16-bit output data is reached and further output modules follow
- An input module, whose process data length cannot be completely incorporated in the preceding word, follows on from another input module
- An output module, whose process data length cannot be completely incorporated in the preceding word, follows on from another output module.

Example station

- Module A: Gateway
- Module B: BL67-4DI-P
- Module C: BL67-2AI-V
- Module D: BL67-8DI-P
- Module E: BL67-4DI-P
- Module F: BL67-8DI-P
- Module G: BL67-8DO-0.5A-P
- Module H: BL67-2AO-I
- Module I: BL67-4DO-0.5A-P
- Module J: BL67-8DI-P
- Module K: BL67-8DO-0.5A-P

Data mapping for gateways with rev. < 1.3.0.16

Table 22: Process image of example station

Produced data (word no.)	**Input data (WORD format) (Bit 15...→ ...0)**
0	Status word (A15 ... A0) of the gateway (see also STATUS REGISTER 2 (page 5-26)
1	B3 ... B0
2	C15 ... C0
3	C31 ... C16
4	E3 ... E0; D7 ... D0
5	J7 ... J0; F7 ... F0
Consumed data (word no.)	**Output data (WORD format) (Bit 15...→ ... 0)**
0	Control word of the gateway (mapped, but **not** defined)
1	G7 ... G0
2	H15 ... H0
3	H31 ... H16
4	K7 ... K0; I3 ... I0

The example station transmits **6 word** input data and **5 word** output data accordingly.

Note

For more information about data mapping, please read also chapter 6, Examples for I/O data mapping (page 6-22) and Mapping report via I/O-ASSISTANT (page 6-25).

Data mapping for gateways with rev. ≥ 1.3.0.16

Table 23: Data mapping for gateways with rev. ≥ 1.3.0.16

Produced Data (word no.)	**Input data**
0	Status word of the gateway (bit assignement, see STATUS REGISTER 2, page 5-26. (Mapping can be disabled using attribute 139 "GW Status Register" in "Gateway Class (VSC 100)", Object Instance 2, page 5-27)
1 to n	Input data of modules. Mapping similar to mapping of gateways with older firmware (see above Data mapping for gateways with rev. < 1.3.0.16 (page 5-14)).
n + y	Summarized diagnostic data (page 4-21) of individual length. Can be enabled/disabled using VSC102, Object instance 3, attr. 104, page 5-30 ff. (y= the no. of following bytes depending on the no. of slices within the station)
n + z	Scheduled diagnostic data (page 4-22). Can be enabled/disabled using VSC102, Object instance 3, attr. 105, page 5-30 ff. (z = data length for the scheduled diagnostics set according to the properties of the modules attached to the gateway)
Consumed Data (word no.)	**Output data**
0	Control word of the gateway (mapped, but **not** defined**)** (Mapping can be disabled using attribute 139 "GW Control Register" in "Gateway Class (VSC 100)", Object Instance 2, page 5-27)
1- n	Output data of the modules. Mapping similar to mapping of gateways with older firmware (see above Data mapping for gateways with rev. < 1.3.0.16 (page 5-14)).

Note

The data mapping can be structured individually. All parts except for the in- and output data of the station can be enabled/ disabled independently from each other.

5.2.5 Connection Manager Object

This object is used for connection and connectionless communications, including establishing connections across multiple subnets.

The following description of the Connection Manager Object is taken from the CIP specification, Vol. 1, Rev. 2.1 by ODVA & ControlNet International Ltd. and adapted to BL67.

Common Services

Table 24: Common services

Service Code	Class	Instance	Service Name
84 (0x54)	no	yes	FWD_OPEN_CMD (Opens a connection)
78 (0x4E)	no	yes	FWD_CLOSE_CMD (Closes a connection)
82 (0x52)	no	yes	UNCONNECTED_SEND_CMD (Unconnected Send Service. Only originating devices and devices that route between links need to implement).

5.2.6 Port Object

The following description of the Port Object is taken from the CIP specification, Vol. 1, Rev. 2.1 by ODVA & ControlNet International Ltd. and adapted to BL67.

Class attributes

Table 25: Class attributes

Attr. No.	Attribute Name	**G**et/ **S**et	Type	Value
1 (0×01)	REVISION	G	UINT	1
2 (0×02)	MAX OBJECT INSTANCE	G	UINT	1
3 (0×03)	NUMBER OF INSTANCES	G	UINT	1
8 (0×08)	ENTRY PORT	G	UINT	1
9 (0×09)	ALL PORTS	G	ARRAY of STRUCT UINT UINT	0,0 for class 4,2 for TCP_IP_PORT

Instance attributes

Table 26: Instance attributes

Attr. No.	Attribute Name	Get/ Set	Type	Description
1 (0×01)	ATTRIBUTE PORT TYPE	G	UINT	4 for TCP_IP_PORT
2 (0×02)	ATTRIBUTE PORT NUMBER	G	UINT	2
3 (0×03)	ATTRIBUTE PORT OBJECT	G	UINT EPATH Logical path	2 0x12, 0x02 0x00, 0x00

Common Services

Table 27: Common services

Service Code	Class	Instance	Service Name
01 (0x01)	yes	yes	Get_Attribute_All
14 (0x0E)	yes	yes	Get_Attribute_Single

5.2.7 TCP/IP Interface Object

The following description of the TCP/IP Interface Object is taken from the CIP specification, Vol. 2, Rev. 1.1 and adapted to BL67.

Class attributes

Table 28: Class attributes

Attr. No.	Attribute Name	Get/ Set	Type	Value
1 (0×01)	REVISION	G	UINT	1
2 (0×02)	MAX OBJECT INSTANCE	G	UINT	1
3 (0×03)	NUMBER OF INSTANCES	G	UINT	1
6 (0×06)	MAX CLASS IDENTIFIER	G	UINT	7
7 (0×07)	MAX INSTANCE ATTRIBUTE	G	UINT	6

Instance attributes

Table 29: Instance attributes

Attr. No.	Attribute Name	Get/ Set	Type	Description
1 (0×01)	STATUS	G	DWORD	Interface status (see page 5-19)
2 (0×02)	CONFIGURATION CAPABILITY	G	DWORD	Interface Capability Flag (see page 5-19)
3 (0×03)	CONFIGURATION CONTROL	G/S	DWORD	Interface Control Flag (see page 5-19)
4 (0×04)	PHYSICAL LINK OBJECT	G	Structure of:	
	Path size		UINT	Number of 16 bit words: 0×02
	Path		Padded EPATH	0×20, 0×F6, 0×24, 0×01
5 (0×05)	INTERFACE CONFIGURATION	G	Structure of:	TCP/IP Network Interface Configuration (see page 5-19)
	IP ADDRESS	G	UDINT	Current IP address
	NETWORK MASK	G	UDINT	Current network mask
	GATEWAY ADDRESS	G	UDINT	Current default gateway
	NAME SERVER	G	UDINT	0 = no name server address configured
	NAME SERVER 2		UDINT	0 = no secondary name server address configured
5 (0×05)	DOMAIN NAME	G	UDINT	0 = no Domain Name configured
6 (0×06)	HOST NAME	G	STRING	0 = no Host Name configured (see page 5-20)

Common Services

Table 30: Common services

Service Code	Class	Instance	Service Name
01 (0x01)	yes	yes	Get_Attribute_All
02 (0x02)	no	no	Set_Attribute_All
14 (0x0E)	yes	yes	Get_Attribute_Single
16 (0×10)	no	yes	Set_Attribute_Single

- **Interface Status**
  The Status attribute indicates the status of the TCP/IP network interface.
  Refer to the state diagram, Figure 29: TCP/IP object state diagram (acc. to CIP Spec., Vol.2, Rev. 1.1) for a description of object states as they relate to the Status attribute.

Table 31: Interface Status

Bit(s)	Name	Definition
0-3	Interface Configuration Status	Indicates the status of the Interface Configuration attribute: 0 = The Interface Configuration attribute has not been configured 1 = The Interface Configuration attribute contains valid configuration. 2 to 15 = Reserved
4 to 31	reserved	

- **Configuration Capability**
  The Configuration Capability indicates the device's support for optional network configuration capability.

Table 32: Configuration Capability

Bit(s)	Name	Definition	Value
0	BOOTP Client	The device is capable of obtaining its network configuration via BOOTP.	1
1	DNS Client	The device is capable of resolving host names by querying a DNS server.	0
2	DHCP Client	The device is capable of obtaining its network configuration via DHCP.	1

- **Configuration Control**
  The Configuration Control attribute is used to control network configuration options.

Table 33: Configuration Control

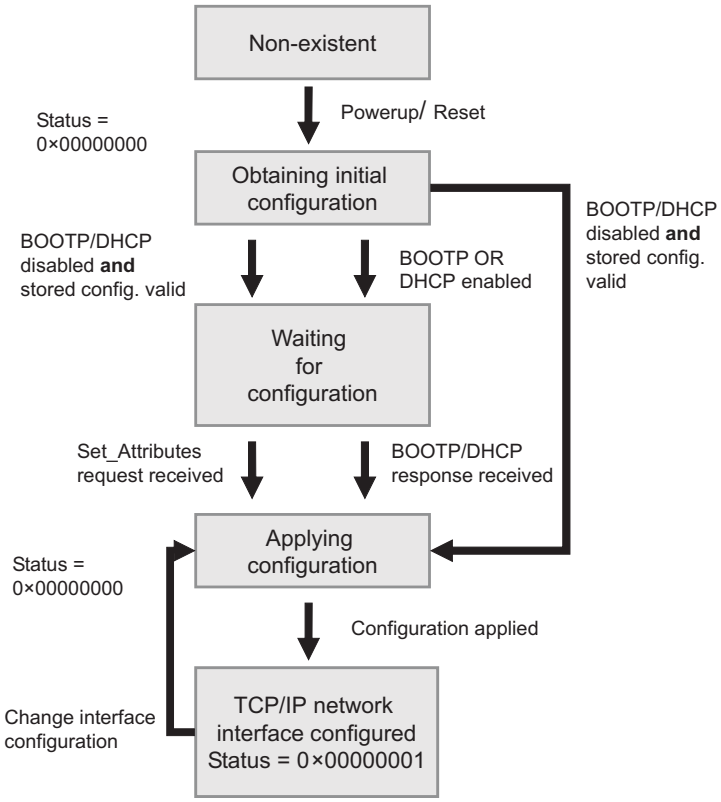
Bit(s)	Name	Definition
0-3	Startup Configuration	Determines how the device shall obtain its initial configuration at start-up. 0 = The device shall use the interface configuration values previously stored (for example, in non-volatile memory or via hardware switches, etc). 1 to 3 = reserved
4	DNS Enable	Always 0
5-31	Reserved	Set to 0.

- **Interface Configuration**
  This attribute contains the configuration parameters required to operate as a TCP/IP node.
  To modify the Interface Configuration attribute, get the Interface Configuration attribute first, change the desired parameters, then set the attribute.
  The TCP/IP Interface Object applies the new configuration upon completion of the Set service. If the value of the Startup Configuration bits (Configuration Control attribute) is 0, the new configuration is stored in non-volatile memory.

The device does not reply to the set service until the values are safely stored to non-volatile memory.
An attempt to set any of the components of the Interface Configuration attribute to invalid values results in an error (status code 0x09) returned from the Set service.
If initial configuration is obtained via BOOTP or DHCP, the Interface Configuration attribute components are all zeros until the BOOTP or DHCP reply is received.
Upon receipt of the BOOTP or DHCP reply, the Interface Configuration attribute shows the configuration obtained via BOOTP/DHCP.

- **Host Name**
  The Host Name attribute contains the device's host name.
  The host name attribute is used when the device supports the DHCP-DNS Update capability and has been configured to use DHCP upon start up.
  The mechanism allows the DHCP client to transmit its host name to the DHCP server. The DHCP server then updates the DNS records on behalf of the client. The host name attribute does not need to be set for the device to operate normally. The value of the Host Name attribute, if it is configured, is used for the value of the FQDN option in the DHCP request. If the Host Name attribute has not been configured, then the device shall not include the FQDN option in the DHCP request.

Figure 29: TCP/IP object state diagram (acc. to CIP Spec., Vol.2, Rev. 1.1)



5.2.8 Ethernet Link Object

The following description of the Ethernet Link Object is taken from the CIP specification, Vol. 2, Rev. 1.1 by ODVA & ControlNet International Ltd. and adapted to BL67.

Class attributes

Table 34: Class attributes

Attr. No.	Attribute Name	Get/ Set	Type	Value
1 (0×01)	REVISION	G	UINT	1
2 (0×02)	MAX OBJECT INSTANCE	G	UINT	1
3 (0×03)	NUMBER OF INSTANCES	G	UINT	1
6 (0×06)	MAX CLASS IDENTIFIER	G	UINT	7
7 (0×07)	MAX INSTANCE ATTRIBUTE	G	UINT	6

Instance attributes

Table 35: Instance attributes

Attr. No.	Attribute Name	Get/ Set	Type	Description
1 (0×01)	INTERFACE SPEED	G	UDINT	Speed in megabits per second (e.g., 10, 100, 1000, etc.)
2 (0×02)	INTERFACE FLAGS	G	DWORD	see Table 36: Interface flags
3 (0×03)	PHYSICAL ADDRESS	G	ARRAY OF USINTs	Contains the interface's MAC address (TURCK: 00:07:46:××:××:××)

Table 36: Interface flags

Bits	Name	Definition	Default-Value
0	Link Status	Indicates whether or not the Ethernet 802.3 communications interface is connected to an active network. 0 = inactive link 1 = active link.	Depends on application
1	Half / Full Duplex	0 = half duplex; 1 = full duplex If the Link Status flag is 0, the value of the Half/Full Duplex flag is indeterminate.	Depends on application
2 to 4	Negotiation Status	Indicates the status of link auto-negotiations. 0 = Auto-negotiation in progress 1 = Auto-negotiation and speed detection failed. Using default values for speed and duplex (10Mbps/half duplex). 2 = Auto negotiation failed but detected speed (default: half duplex). 3 = Successfully negotiated speed and duplex. 4 = Auto-negotiation not attempted. Forced speed and duplex.	Depends on application
5	Manual Setting Requires Reset	0 = interface can activate changes to link parameters (auto-negotiate, duplex mode, interface speed) automatically 1 = device requires a Reset service to be issued to its Identity Object in order to adapt the changes	1
6	Local Hardware Fault	0 = interface detects no local hardware fault 1 = a local hardware fault is detected	0

Common services

Table 37: Common services

Service Code	Class	Instance	Service Name
01 (0x01)	yes	yes	Get_Attribute_All
14 (0x0E)	yes	yes	Get_Attribute_Single
76 (0×4C)	no	yes	Enetlink_Get_and_Clear

5.3 VSC-Vendor Specific Classes

In addition to supporting the above named CIP Standard Classes, the BL67 gateway for EtherNet/IP supports the below vendor specific classes.

The VSC describing the possible DeviceNet-master function (VSC 122 and VSC 123) of an EtherNet/IP gateway can be found in a separate manual (D301118).

It is possible to gain read (**G**= Get) and/or write (**S**= Set) access to the attributes of classes described in the following:

Table 38: VSC-Vendor Specific Classes

Class Code	Name	Description
100 (0×64)	Gateway Class, page 5-26	Contains data concerning the gateway.
101 (0×65)	Terminal Slot Class, page 5-28	Contains data concerning the base modules
102 (0×66)	Process Data Class, page 5-30	Contains process data
103 (0×67)	Power Supply Module Class, page 5-32	Describes the power distribution modules
104 (0×68)	Digital Input Module Class, page 5-34	Describes the modules of the type BL67-*DI-*
105 (0×69)	Digital Output Module Class, page 5-36	Describes the modules of the type BL67-*DO-*
106 (0×6A)	Analog Input Voltage Module Class, page 5-38	Describes the modules of the type BL67-*AI-V
107 (0×6B)	Analog Output Voltage Module Class, page 5-40	Describes the modules of the type BL67-*AO-V
108 (0×6C)	Analog Input Current Module Class, page 5-42	Describes the modules of the type BL67-*AI-I
109 (0×6D)	Analog Output Current Module Class, page 5-44	Describes the modules of the type BL67-*AO-I
110 (0×6E)	Analog Input RTD Module Class, page 5-46	Describes the modules of the type BL67-*AI- PT
111 (0×6F)	Analog Input THERMO Module Class, page 5-50	Describes the modules of the type BL67-*AI-TC
112 (0×70)	reserved	-
113 (0×71)	reserved	-
114 (0×72)	RS232 Module Class, page 5-53	Describes the modules of the type BL67-1RS232
115 (0×73)	RS4xx Module Class, page 5-60	Describes the modules of the type BL67-1RS422/485
116 (0×74)	SSI Module Class, page 5-67	Describes the modules of the type BL67-1SSI
117 (0×75)	Digital Versatile Module Class, page 5-75	Describes the modules of the type BL67-4DI4DO, BL67-8XSG etc.

Table 38: VSC-Vendor Specific Classes

Class Code	Name	Description
100 (0×64)	Gateway Class, page 5-26	Contains data concerning the gateway.
118 (0×76)	Analog Versatile Module Class, page 5-79	Describes the modules of the type BL67-xAI/AO-x
119 (0×77)	CVI Module Class, page 5-82	Describes the modules of the type BL67-1CVI
122 (0×7A)	DeviceNet™ Master Class	Description in a separate manual (D301118 "DeviceNet™-Master User Manual").
123 (0×7B)	DeviceNet™ Slave Class	
124 (0×7C)	RFID -S Module Class, page 5-85	Describes the modules of the type BL67-2RFID-S

5.3.1 Class instances of the VSC

Note

Class instance attributes are the same for each Vendor Specific Class.

Class-specific Object instances and the corresponding attributes are explained below for the different VSC.

The general VSC - Class instance attributes are defined as follows:

Table 39: Class instance

Attr. No.	Attribute Name	Get/ Set	Type	Description
100 (0×64)	CLASS REVISION	G	UINT	States the revision number of the class: Maj. Rel. *1000 + Min. Rel..
101 (0×65)	MAX INSTANCE	G	USINT	Contains the number of the highest instance of an object created on this level in the class hierarchy.
102 (0×66)	# OF INSTANCES	G	USINT	Contains the number of Object instances created in this class.
103 (0×67)	MAX CLASS ATTRIBUTE	G	USINT	Contains the number of the last Class Attribute to be implemented.

5.3.2 Gateway Class (VSC 100)

The Gateway Class contains all the parameters of the BL67 system and the gateway.

Note

Please refer to paragraph Class instances of the VSC, page 5-25, for the description of the class instances for VSC.

Object instances

Table 40: Object instance 2, Gateway Instance

Attr. No.	Attribute Name	Get/ Set	Type	Description
109 (0×6D)	STATUS REGISTER 2	G	STRUCT	Gateway-Status contains general gateway status information: **Gateway** – Bit 15: "I/O Controller Error" The communication controller for the I/O-system is faulty. – Bit 14: "Force Mode Active Error" The Force Mode is activated. – Bit 13: reserved – Bit 12: reserved **Module bus** – Bit 11: "I/O Cfg Modified Error" The I/O-configuration has been changed and is now incompatible. – Bit 10: "I/O Communication Lost Error" No communication on the I/O module bus. **Voltage errors** Bit 09: "U_{sys} too low" System supply voltage too low (< 18 VDC). Bit 08: "U_{sys} too high" System supply voltage too high (> 30 VDC). Bit 07: "U_L too low" Load voltage too low (< 18 VDC). Bit 06: "U_L too high" Load voltage too high (> 30 VDC) Bit 05: "I_{sys} too high" Overload of the system voltage supply. Bit 04: reserved **Warnings** Bit 03: "I/O Cfg Modified Warning" Bit 02: reserved Bit 01: reserved Bit 00: "I/O Diags Active Warning" At least one I/O-module sends active diagnosics.

Table 40: Object instance 2, Gateway Instance

Attr. No.	Attribute Name	Get/ Set	Type	Description
115 (0×73)	ON IO CONNECTION TIMEOUT	G/S	ENUM USINT	Reaction to the I/O connection exceeding the time limit. SWITCH IO FAULTED (0): The modules are switched to Faulted State. SWITCH IO OFF (1): The gateway switches off the outputs of the modules. SWITCH IO HOLD (2): The gateway makes no further changes to the data of the I/O modules. The outputs are held.
116 (0×74)	MODULE DIAG SUMMARY	G	ARRAY OF STRUCT	Contains diagnostic information for all modules. ARRAY OF STRUCT: USINT SLOT #: Indicates the slot number (module position) with diagnostic messages. BYTE SLOT FLAGS: Offers slot-related information. Bit 7 = module missing Bit 6 = false module plugged DWORD DIAG: Contains the module diagnostic information. Module diagnostic bits that are not used are indicated by a "0".
117-137 (0×75 - (0×89)	reserviert			
138 (0×8A)	GW Status Register	Get/Set	UINT	Allows to enable/disable the GW status register which is part of the input data.
139 (0×8B)	GW Control Register	Get/Set	UINT	Allows to enable/disable the GW cotnrol register which is part of the output data.

5.3.3 Terminal Slot Class (VSC 101)

This class contains parameters and data for the base modules.

Note

Please refer to paragraph Class instances of the VSC, page 5-25, for the description of the class instance for the VSC.

Object instance

Table 41: Object instances

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Slot state	G	ENUM USINT	NOT USED (0): A non-occupied slot is not taking part in process data traffic. It is not responding to data transmitted or received via I/O Connection Messages. PROCESSING (1): A BL67 module, recognized by the fieldbus is occupying a slot. Data transfer is taking place with the other fieldbus devices via I/O Connection Messages. ALLOCATED (2): The slot is not occupied, but has been reserved for a certain electronic module. The process data are set to 0. WRONG MODULE (3): The wrong module has been plugged in the slot, meaning, it supports process data lengths that were not previously defined or it is a different type of module. This false module will not be made known to the fieldbus and will not take part in process data traffic. The process data for this slot are set to 0.
103 (67h)	Module ID	G	DWORD	Contains the ID of the BL67 module.
104 (68h)	Module diag bit count	G	UINT	States the number of diagnostic bits of the module.
105 (69h)	Module param bit count	G	UINT	States the number of parameter bits of the module.
106 (6Ah)	Module diag bit count	G	UINT	States the number of input bits (produced bits) of the module.

Table 41: Object instances

Attr. No. dec. (hex.)	Attribute name	Get/ Set	Type	Description
107 (6Bh)	Module output bit count	G	UINT	States the number of output bits (consumed bits) of the module.
108 (6Ch)	Module submode	G	USINT	Contains the submode ID of the BL67 module.
109 (6Dh	Module group count	G	USINT	States the number of internal groups of the module.
110 (6Eh)	Diag	G	ARRAY OF BYTE	Contains the diagnostic information of the module.
111 (6Fh)	Param	G/S	ARRAY OF BYTE	Contains the parameters of the module.
112 (70h)	input	G	ARRAY OF BYTE	Contains the input data (produced data) of the module.
113 (71h)	output	G/S	ARRAY OF BYTE	Contains the output data (consumed data) of the module.
114 (72h)	Referenced VSC	G	USINT	The VSC that represents this BL67 module. If this module is contained in the internal gateway library, then it is listed in a specific VSC that describes the typical attributes of the module.
115 (73h)	Referenced VSC instance	G	USINT	The VSC Instance that represents this BL67 module. If this module is contained in the internal gateway library, then it is listed in a specific VSC that describes the typical attributes of the module.
116 (74h)	Module registered Index	G/S	ENUM USINT	Contains the index numbers specified in all the module lists.

5.3.4 Process Data Class (VSC102)

This class contains the process-relevant information.

Note

Please refer to paragraph Class instances of the VSC, page 5-25, for the description of the class instance for the VSC.

Object instance 1, standard input process data (compressed)

Table 42: Object instance 1, standard input process data (compressed)

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Attribute list	G	ARRAY OF USINT	List of all attributes that are supported by this Instance.
102 (66h)	Standard packed process input data	G	ARRAY OF WORD	Input process data, 16-bit aligned, compressed.
103 (67h)	Process data byte count	G	USINT	The number of bytes that are exchanged with this Instance.

Note

The following object instances (Object instance 2 to Object instance 8) are only valid for gateways with **Rev.** ≥ **1.3.0.16**.

Object instance 2, standard output process data (compressed)

Table 43: Object instance 2, standard output process data (compressed)

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Attribute list	G	ARRAY OF USINT	List of all attributes that are supported by this Instance.
102 (66h)	Standard packed process output data	G/S	ARRAY OF WORD	Output process data, 16-bit aligned, compressed.
103 (67h)	Process data byte count	G	USINT	The number of bytes that are exchanged with this Instance.

Object instance 3, diagnostic instance

Table 44: Object instance 3, diagnostic instance

Attr. No. dec. (hex.)	Attribute name	Get/ Set	Type	Description
104 (68h)	GW summarized diagnostics	G/S	BOOL	0 = disabled 1 = enabled: 1 bit of diagnosis per slot mapped at the end of the input data image (page 4-21). The actual data is loaded to the non-volatile memory of the gateway. Changes become valid after a start-up!
105 (69h)	GW scheduled diagnostics	G/S	BOOL	0 = disabled 1 = enabled: time sliced module related data block using a round robin mechanism (page 4-22). The actual data is loaded to the non-volatile memory of the gateway. Changes become valid after a start-up!
106 (6Ah)	reserved			
107 (6Bh)	I-MAP summarized diags	G	USINT	Contains the number of summarized diagnostic bytes. Changes become valid after a start-up!
108 (6Ch)	I-MAP scheduled diags	G	USINT	Contains the number of scheduled diagnostics bytes. Changes become valid after a start-up!

Object instance 4, COS/CYCLIC instance

Table 45: Object instance 4, COS/CYCLIC instance

Attr. No. dec. (hex.)	Attribute name	Get/ Set	Type	Description
104 (68h)	COS data mapping	G/S	ENUM USINT	Currently not supported

5.3.5 Power Supply Module Class (VSC103)

This class contains all the relevant information and parameters for the power distribution modules.

Note

Please refer to paragraph Class instances of the VSC, page 5-25, for the description of the class instance for the VSC.

Object instance

Table 46: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "BL67-PF-24VDC"
106 (6Ah)	Module revision	G	USINT	Contains the revision number of the module firmware.
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: – 0×00: type of module unknown (default) – 0×01: digital module – 0×11: analog voltage mod. – 0×12: analog current mod. – 0×13: analog RTD mod. – 0×14: analog THERMO mod. – 0×1F: analog volt./curr. mod. – 0×22: counter/incr. encoder 32bit – 0×28: SSI interface – 0×31: starter, mechanical – 0×32: starter, electronical – 0×41: RS232 mod. – 0×42: RS485/RS422 mod. – 0×46: RFID module – 0×51: CVI mod.

Table 46: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the BL67 module. ARRAY OF: BYTE: Control byte sequence
109 (6Dh	Module response interface	G	ARRAY	Response interface of the BL67 module. ARRAY OF: BYTE: Response byte sequence
110 (6Eh)	Diag size	G	UINT	Indicates the number of diagnostic bits of the module.
111 (6Fh)	Diag	G	WORD	Contains the diagnostic information of the module. WORD: Bit for bit assignment according to module specification.
112 (70h)	Module registered index	G	ENUM USINT	Contains the index numbers specified in all the module lists.

5.3.6 Digital Input Module Class (VSC104)

This Class contains all information and parameters for digital input modules.

Note

Please refer to paragraph Class instances of the VSC, page 5-25, for the description of the class instance for the VSC.

Object instance

Table 47: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "BL67-4DI-P".
106 (6Ah)	Module revision	G	USINT	Contains the revision number of the module firmware.
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: – see attribute 107 (6Bh) on page 5-32
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the BL67 module. ARRAY OF: BYTE: Control byte sequence
109 (6Dh	Module response interface	G	ARRAY	Response interface of the BL67 module. ARRAY OF: BYTE: Response byte sequence
110 (6Eh)	Produced data size	G	UINT	Contains information concerning the range of data produced by the module.

Table 47: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
111 (6Fh)	Produced data	G	DWORD	Contains the input data of the module. DWORD: Bit for bit assignment according to module specification.
112 (70h)	Diag size	G	UINT	Contains information concerning the range of the diagnostic data of the module.
113 (71h)	Diag	G	DWORD	Contains the diagnostic information of the module. DWORD: Bit for bit assignment according to module specification.
114 (72h)	Param size	G	UINT	Contains information concerning the range of parameters of the module.
115 (73h)	Params	G/S	DWORD	Contains the parameters of the module. DWORD: Bit for bit assignment according to module specification.
116 (74h)	Module registered Index	G	ENUM USINT	Contains the index numbers specified in all the module lists.

5.3.7 Digital Output Module Class (VSC105)

This Class contains all information and parameters for digital output modules.

Note

Please refer to paragraph section "Class instances of the VSC", page 5-25, for the description of the class instance for the VSC.

Object instance

Table 48: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "BL67-4DO-0.5A-P".
106 (6Ah)	Module revision	G	USINT	Contains the revision number of the module firmware.
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: – see attribute 107 (6Bh) on page 5-32
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the BL67 module. ARRAY OF: BYTE: Control byte sequence
109 (6Dh	Module response interface	G	ARRAY	Response interface of the BL67 module. ARRAY OF: BYTE: Response byte sequence
110 (6Eh)	Consumed data size	G	UINT	Contains information concerning the range of data consumed by the module.

Table 48: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
111 (6Fh)	Consumed data	G	DWORD	Contains the output data of the module. DWORD: Bit for bit assignment according to module specification.
112 (70h)	Diag size	G	UINT	Contains information concerning the range of the diagnostic data of the module.
113 (71h)	Diag	G	DWORD	Contains the diagnostic information of the module. DWORD: Bit for bit assignment according to module specification.
114 (72h)	Param size	G	UINT	Contains information concerning the range of parameters of the module.
115 (73h)	Params	G/S	DWORD	Contains the parameters of the module. DWORD: Bit for bit assignment according to module specification.
116 (74h)	Module registered Index	G	ENUM USINT	Contains the index numbers specified in all the module lists.

5.3.8 Analog Input Voltage Module Class (VSC106)

This Class contains all information and parameters for analog input modules (voltage).

Note

Please refer to paragraph section "Class instances of the VSC", page 5-25, for the description of the class instance for the VSC.

Object instance

Table 49: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "BL67-2AI-V".
106 (6Ah)	Module revision	G	USINT	Contains the revision number of the module firmware.
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: – see attribute 107 (6Bh) on page 5-32
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the BL67 module. ARRAY OF: BYTE: Control byte sequence
109 (6Dh	Module response interface	G	ARRAY	Response interface of the BL67 module. ARRAY OF: BYTE: Response byte sequence
110 (6Eh)	Module registered index	G	ENUM USINT	Contains the index numbers specified in all the module lists.

Table 49: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
111 (6Fh)	Number of supported channels	G	USINT	States the number of analog input channels supported by this module Instance.
112 - 119 (70h - 77h)	Produced data	G	INT	Contains the data transmitted by the analog input module of channels No. 1 to No. 8. Only those channels are supported that are contained in attribute 111, „Number of supported channels“. Attribute 112 contains the data for channel 1, attribute 119 for channel 8.
120 - 127 (78h - 7Fh)	Diag data	G	BYTE	Contains the diagnostic data of the channels 1 to 8 of the analog input module. Only those channels are supported that are defined in attribute 111, Number of supported channels. Attribute 120 contains the data for channel 1, attribute 127 for channel 8. BYTE diag: Bit0: 0 = ok 1 = measurement value range error Bit1 to 7: reserved
128 - 135 (80h - 87h)	Mode parameter data	G/S	BYTE	Contains the diagnostic data of the channels 1 to 8 of the analog input module. Only those channels are supported that are defined in attribute 111, „Number of supported channels“. Attribute 128 contains the data for channel 1, attribute 135 for channel 8. BYTE mode: Bit0: Voltage mode: 0 =0....10 V 1 =-10 V10 V....+10 V Bit 1: Value representation 0 =Integer (15 Bit + sign) 1 =12 Bit (left-justified) Bit 2: Diagnostic: 0 = enable 1 = disable Bit 3 to 7: reserved

5.3.9 Analog Output Voltage Module Class (VSC107)

This Class contains all information and parameters for analog output modules (voltage).

Note

Please refer to paragraph section "Class instances of the VSC", page 5-25, for the description of the class instance for the VSC.

Object instance

Table 50: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "BL67-2AO-V".
106 (6Ah)	Module revision	G	USINT	Contains the revision number of the module firmware.
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: – see attribute 107 (6Bh) on page 5-32
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the BL67 module. ARRAY OF: BYTE: Control byte sequence
109 (6Dh	Module response interface	G	ARRAY	Response interface of the BL67 module. ARRAY OF: BYTE: Response byte sequence
110 (6Eh)	Module registered Index	G	ENUM USINT	Contains the index numbers specified in all the module lists.

Table 50: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
111 (6Fh)	Number of supported channels	G	USINT	States the number of analog input channels supported by this module Instance.
112 - 119 (70h - 77h)	Consumed data	G	INT	Contains the data received by the analog output module of channels No. 1 to No. 8. Only those channels are supported that are contained in attribute 111„Number of supported channels“. Attribute 112 contains the data for channel 1, attribute 119 for channel 8.
120 - 127 (78h - 7Fh)	Diag data	G	BYTE	Contains the diagnostic data of the channels 1 to 8 of the analog output module. Only those channels are supported that are defined in attribute 111, „Number of supported channels“. Attribute 120 contains the data for channel 1, attribute 127 for channel 8. BYTE diag: Bit 0 to 7: reserved
128 - 135 (80h - 87h)	Mode parameter data	G/S	BYTE	Contains the diagnostic data of the channels 1 to 8 of the analog output module. Only those channels are supported that are defined in attribute 111, „Number of supported channels“. Attribute 128 contains the data for channel 1, attribute 135 for channel 8. BYTE mode: Bit0: Voltage mode: 0 = 0....10 V 1 = -10 V....+10 V Bit1: Value representation 0 = Integer (15 Bit + sign) 1 = 12 Bit (left-justified) Bit2 to 7: reserved
136 - 143 (88h - 8Fh)	Fault value parameter data	G/S	INT	Contains the Fault Value-Definition of the channels 1 to 8 of the analog output modules. Only those channels are supported that are defined in attribute 111, „Number of supported channels“. Attribute 136 contains the data for channel 1, attribute 143 for channel 8.

5.3.10 Analog Input Current Module Class (VSC108)

This Class contains all information and parameters for analog input modules (current).

Note

Please refer to paragraph section "Class instances of the VSC", page 5-25, for the description of the class instance for the VSC.

Object instance

The Object instances/ attributes of the analog input modules (current) correspond to those of the analog input modules (voltage). Differences are only to be found in the attributes no. 112 to 135 that concern the measurement ranges of the modules (current or voltage measurements).

Table 51: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
112 - 119 (70h - 77h)	Produced data	G	INT	Contains the data transmitted by the analog input module of channels No. 1 to No. 8. Only those channels are supported that are contained in attribute 111, „Number of supported channels“. Attribute 112 contains the data for channel 1, attribute 119 for channel 8.
120 - 127 (78h - 7Fh)	Diag data	G	BYTE	Contains the diagnostic data of the channels 1 to 8 of the analog input module. Only those channels are supported that are defined in attribute 111, „Number of supported channels“. Attribute 120 contains the data for channel 1, attribute 127 for channel 8. BYTE diag: Bit 0: 0 = ok 1 = measurement value range error Bit 1: 0 =ok 1 =open circuit; only in measurement range: 4 to 20mA Bit 2 to 7: reserved

Table 51: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
128 - 135 (80h - 87h)	Mode parameter data	G/S	BYTE	Contains the diagnostic data of the channels 1 to 8 of the analog input module. Only those channels are supported that are defined in attribute 111, „Number of supported channels“. Attribute 128 contains the data for channel 1, attribute 135 for channel 8. BYTE mode: Bit 0: Current mode: 0 = 0 to 20mA 1 = 4 to 20mA Bit 1: Value representation: 0 =Integer (15 Bit + sign) 1 =12 Bit (left-justified) Bit 2: Diagnostic: 0 = enable 1 = disable Bit 3 to 7:reserved

5.3.11 Analog Output Current Module Class (VSC109)

This Class contains all information and parameters for analog output modules (current).

Note

Please refer to paragraph section "Class instances of the VSC", page 5-25, for the description of the class instance for the VSC.

Object instance

The Object instances/attributes of the analog output modules (current) correspond to those of the analog output modules (voltage). Differences are only to be found in the attributes no. 112 to 143 that concern the measurement ranges of the modules (current or voltage measurements).

Table 52: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
112 - 119 (70h - 77h)	Consumed data	G	INT	Contains the data received by the analog output module of channels No. 1 to No. 8. Only those channels are supported that are contained in attribute 111, „Number of supported channels“. Attribute 112 contains the data for channel 1, attribute 119 for channel 8.
120 - 127 (78h - 7Fh)	Diag data	G	BYTE	Contains the diagnostic data of the channels 1 to 8 of the analog output module. Only those channels are supported that are defined in attribute 111, „Number of supported channels“. Attribute 120 contains the data for channel 1, attribute 127 for channel 8. BYTE diag: Bit 0 to 7: reserved
128 - 135 (80h - 87h)	Mode parameter data	G/S	BYTE	Contains the diagnostic data of the channels 1 to 8 of the analog output module. Only those channels are supported that are defined in attribute 111, „Number of supported channels“. Attribute 128 contains the data for channel 1, attribute 135 for channel 8. BYTE mode: Bit 0: Current mode: 0 = 0 to 20mA 1 = 4 to 20mA Bit 1: Value representation: 0 =Integer (15 Bit + sign) 1 =12 Bit (left-justified) Bit 2 to 7:reserved

Table 52: Object instance

Attr. No. dec. (hex.)	Attribute name	Get/ Set	Type	Description
136 - 143 (88h - 8Fh)	Fault value parameter data	G/S	INT	Contains the Fault Value-Definition of the channels 1 to 8 of the analog output modules. Only those channels are supported that are defined in attribute 111, „Number of supported channels“. Attribute 136 contains the data for channel 1, attribute 143 for channel 8.

5.3.12 Analog Input RTD Module Class (VSC110)

This Class contains all information and parameters for analog input modules for PT100/NI sensors (current).

Note

Please refer to paragraph section "Class instances of the VSC", page 5-25, for the description of the class instance for the VSC.

Object instance

Table 53: Object instance

Attr. No. dec. (hex.)	Attribute name	Get/ Set	Type	Description
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "BL67-2AI-PT".
106 (6Ah)	Module revision	G	USINT	Contains the revision number of the module firmware.
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: – see attribute 107 (6Bh) on page 5-32
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the BL67 module. ARRAY OF: BYTE: Control byte sequence
109 (6Dh	Module response interface	G	ARRAY	Response interface of the BL67 module. ARRAY OF: BYTE: Response byte sequence
110 (6Eh)	Module registered Index	G	ENUM USINT	Contains the index numbers specified in all the module lists.

Table 53: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
111 (6Fh)	Number of supported channels	G	USINT	States the number of analog input channels supported by this module Instance.
112 - 119 (70h - 77h)	Produced data	G	INT	Contains the data received by the analog input module of channels No. 1 to No. 8. Only those channels are supported that are contained in attribute 111, Number of supported channels. Attribute 112 contains the data for channel 1, attribute 119 for channel 8.
120 - 127 (78h - 7Fh)	Diag data	G	BYTE	Contains the diagnostic data of the channels 1 to 8 of the analog input module. Only those channels are supported that are defined in attribute 111, „Number of supported channels“. Attribute 120 contains the data for channel 1, attribute 127 for channel 8. BYTE diag: Bit 0: 0 = ok 1 = measurement value range error Bit 1: 0 = ok 1 = open circuit Bit 2: 0 = ok 1 = short-circuit

Table 53: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
128 -135 (80h -87h)	Mode parameter data	G/S	BYTE	Contains the diagnostic data of the channels 1 to 8 of the analog input module. Only those channels are supported that are defined in attribute 111, „Number of supported channels“. Attribute 128 contains the data for channel 1, attribute 135 for channel 8. BYTE mode: Bit 0: Mains suppression 0 = 50Hz mains suppression 1 = 60Hz mains suppression Bit 1: value representation: 0 = Integer (15 Bit + sign) 1 = 12 Bit (left-justified) Bit 2: Diagnose: 0 = release 1 = block Bit 3:Channel: 0 = activate channel 1 = deactivate channel Bit 4: Measurement mode: 0 = 2-wire 1 = 3-wire Bit 5 to 7: reserved

Table 53: Object instance

Attr. No. dec. (hex.)	Attribute name	Get/ Set	Type	Description
136 -143 (88h - 8Fh)	Sensor parameter data	G/S	ENUM USINT	Contains the sensor-specific parameter data of the channels 1 to 8 of the analog input module. Only those channels are supported that are defined in attribute 111, „Number of supported channels“. Attribute 136 contains the data for channel 1, attribute 143 for channel 8. ENUM USINT: Element: 0: PT100, -200...850°C 1:PT100, -200...150°C 2: NI100, -60...250°C 3:NI100, -60...150°C 4:PT200, -200...850°C 5: PT200, -200...150°C 6: PT500, -200...850°C 7: PT500, -200...150°C 8: PT1000, -200...850°C 9: PT1000, -200...150°C 10: NI1000, -60...250°C 11: NI1000, -60...150°C 12: resistance: 0...100Ω 13: resistance: 0...200Ω 14: resistance: 0...400Ω 15: resistance: 0...1000Ω 16 to 255: reserved

5.3.13 Analog Input THERMO Module Class (VSC111)

This Class contains all information and parameters for analog input modules for thermocouples.

Note

Please refer to paragraph section "Class instances of the VSC", page 5-25, for the description of the class instance for the VSC.

Object instance

Table 54: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "BL67-2AI-TC".
106 (6Ah)	Module revision	G	USINT	Contains the revision number of the module firmware.
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: – see attribute 107 (6Bh) on page 5-32
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the BL67 module. ARRAY OF: BYTE: Control byte sequence
109 (6Dh	Module response interface	G	ARRAY	Response interface of the BL67 module. ARRAY OF: BYTE: Response byte sequence
110 (6Eh)	Module registered Index	G	ENUM USINT	Contains the index numbers specified in all the module lists.

Table 54: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
111 (6Fh)	Number of supported channels	G	USINT	States the number of analog input channels supported by this module Instance.
112 - 119 (70h - 77h)	Produced data	G	INT	Contains the data received by the analog input module of channels No. 1 to No. 8. Only those channels are supported that are contained in attribute 111, „Number of supported channels“. Attribute 112 contains the data for channel 1, attribute 119 for channel 8.
120 - 127 (78h - 7Fh)	Diag data	G	BYTE	Contains the diagnostic data of the channels 1 to 8 of the analog input module. Only those channels are supported that are defined in attribute 111, „Number of supported channels“. Attribute 120 contains the data for channel 1, attribute 127 for channel 8. BYTE diag: Bit 0: 0 = ok 1 = measurement value range error Bit 1: 0 =ok 1 =open circuit Bit 2 to 7:reserved
128 - 135 (80h - 87h)	Mode parameter data	G/S	BYTE	Contains the diagnostic data of the channels 1 to 8 of the analog input module. Only those channels are supported that are defined in attribute 111, „Number of supported channels“. Attribute 128 contains the data for channel 1, attribute 135 for channel 8. BYTE mode: Bit 0: Mains suppression 0 = 50Hz mains suppression 1 = 60Hz mains suppression Bit 1: value representation: 0 =Integer (15 Bit + sign) 1 =12 Bit (left-justified) Bit 2: Diagnose: 0 = release 1 = block Bit 3:Channel: 0 = activate channel 1 = deactivate channel Bit 4 to 7: reserved

Table 54: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
136 - 143 (88h - 8Fh)	Sensor parameter data	G/S	ENUM USINT	Contains the sensor-specific parameter data of the channels 1 to 8 of the analog input module. Only those channels are supported that are defined in attribute 111, „Number of supported channels“. Attribute 136 contains the data for channel 1, attribute 143 for channel 8. ENUM USINT: Element: 0: Type K -270....1370 °C 1: Type B 100....1820 °C 2: Type E -270....1000 °C 3: Type J -210....1200 °C 4: Type N -270....1300 °C 5: Type R -50....1760 °C 6: Type S -50....1540 °C 7: Type T -270....400 °C 8: ±50mV 9: ±100mV 10: ±500mV 11: ±1000mV 12 to 255: reserved

5.3.14 RS232 Module Class (VSC114)

This Class contains all information and parameters for RS232 modules.

Note

Please refer to paragraph section "Class instances of the VSC", page 5-25, for the description of the class instance for the VSC.

Object instance

Table 55: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "BL67-1RS232".
106 (6Ah)	Module revision number	G	USINT	Contains the revision number of the module firmware.
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: – see attribute 107 (6Bh) on page 5-32
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the BL67 module. ARRAY OF: BYTE: Control byte sequence
109 (6Dh	Module response interface	G	ARRAY	Response interface of the BL67 module. ARRAY OF: BYTE: Response-byte sequence
110 (6Eh)	Module registered Index	G	ENUM USINT	Contains the index numbers specified in all the module lists.

Table 55: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
111 (6Fh)	Number of supported channels	G	USINT	States the number of analog input channels supported by this module Instance.
112 (70h)	RX byte count	G	USINT	Number of the valid bytes (0 to 7) in this data segment.
113 (71h)	RX count	G	USINT	This value is transferred together with every data segment of the process input data. The RX count values are sequential: 00->01->10->11->00.... (decimal: 0->1->2->3->0....) Errors in this sequence show the loss of data segments.
114 (72h)	TX count acknowledge	G	USINT	This value is a copy of the value TX count. TX count has been transmitted together with the last data segment of the process output data. TX count acknowledge is an acknowledge for the successful transmission of the data segment with TRANSMIT count.
115 (73h)	Status	G	BOOL	0 = The communication with the data terminal equipment (DTE) is disturbed. A diagnostic message is generated if the parameter "Diagnostics“ is set to "0/ release“. The diagnostic data show the cause of the communication disturbance. The user has to set back this bit in the process output data by using STATRES. 1 = The communication with the data terminal equipment (DTE) is error free,

Table 55: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
116 (74h)	Process diagnostics data	G	BYTE	Contains the diagnostic information: The diagnostic data are part of the process input data, if ACTIVE MODE = 1 or 2bytes "ctrl/status header" is set. Diagnostics messages: – Bit 0 to Bit 2: reserved – Bit 3: 0 = ok 1 = parameter error: The set parameter values are not supported. – Bit 4: 0 = ok 1 = hardware failure: The module has to be replaced, e.g. EEPROM or UART may be defect. – Bit 5: 0 = ok 1 = handshake error: The DTE connected to the module does not answer a XOFF or RTS handshake. This may cause a overflow in the internal receive-buffer. – Bit 6: 0 = ok 1 = frame error: The module has to be parameterized to be adapted to the data structure of the connected DTE. A frame error occurs if the parameterization (number of data bits, stop bits, parity) is not correct. – Bit 7: 0 = ok 1 = buffer overflow: Overflow in the RX-buffer. – Bit 8 to Bit 15: reserved
117 (75h)	RX data	G	ARRAY OF BYTE	Defines the receive-data (0...7).
118 (76h)	RX data and release	G	ARRAY OF BYTE	Defines the data received via RS232 (0...7) + acknowledge for reception
119 (77h)	TX byte count	G/S	USINT	Number of the valid user data bytes in this data segment. I

Table 55: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
120 (78h)	TX count	G/S	USINT	This value is transferred together with every data segment. The TX count values are sequential: 00->01->10->11->00.... (decimal: 0->1->2->3->0....) Errors in this sequence show the loss of data segments.
121 (79h)	RX count acknowledge	G/S	USINT	This value is a copy of RX count. RX count has been transmitted together with the last data segment of the process input data. RX count acknowledge is an acknowledge for the successful transmission of the data segment with RX count.
122 (7Ah)	Status reset control	G/S	BOOL	STATRES: This bit is set to reset the STAT bit in the process input data. With the change from 1 to 0 the status bit is reset (from 0 to 1). If this bit is 0, all changes in TRANSMIT BYTE count, TRANSMIT count and RECEIVE count acknowledge are ignored. Flushing the transmit-/ receive-buffer with process control data (Attr. 123) is possible. If this bit is 1 or with the change from 0 to 1, the flushing of the transmit-/ receive-buffer with process control data (Attr. 123) is not possible.
123 (7Bh)	Process control data	G/S	BYTE	Bit 0 = transmit-buffer flush, Bit 1 = receive-buffer flush
124 (7Ch)	TX data	G/S	ARRAY OF BYTE	Defines the transmit-data (0...7)
125 (7Dh)	TX data and release	S	ARRAY OF BYTE	Defines the data to be transmitted via RS232 (0...7) + transmission is released/ charged immediately
126 (7Eh)	reserved			

Table 55: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
127 (7Fh)	Diagnostics	G	WORD	Contains the diagnostic messages (low byte): Diagnostics messages: – Bit 0 to Bit 2: reserved – Bit 3: 0 = ok 1 = parameter error: The set parameter values are not supported. – Bit 4: 0 = ok 1 = hardware failure: The module has to be replaced, e.g. EEPROM or UART may be defect. – Bit 5: 0 = ok 1 = handshake error: The DTE connected to the module does not answer a XOFF or RTS handshake. This may cause a overflow in the internal receive-buffer. – Bit 6: 0 = ok 1 = frame error: The module has to be para-meterized to be adapted to the data structure of the connected DTE. A frame error occurs if the parameterization (number of data bits, stop bits, parity) is not correct. – Bit 7: 0 = ok 1 = buffer overflow: Overflow in the RX-buffer. – High byte: reserved
128 (80h)	Active mode	G/S	BOOL	0 = 1byte ctrl/status header: The diagnostic data are not part of the process input data, 7 bytes of user data are available. 1 = 2byte ctrl/status header: The diagnostic data are part of the process input data, 6 bytes of user data are available.

Table 55: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
129 (81h)	Bit rate	G/S	ENUM USINT	Used to set the baudrate for the gateway: 0 = reserved, 1 = 300 bps 2 = 600 bps 3 = 1200 bps 4 = 2400 bps 5 = 4800 bps 6 = 9600 bps 7 = 14400 bps 8 = 19200 bps 9 = 28800 bps 10 = 38400 bps 11 = 57600 bps 12 = 115200 bps ... 15 = reserved)
130 (82h)	Disable diagnostics	G/S	BOOL	0 = released: The diagnostic function is activated. 1 = blocked: The diagnostic function is deactivated.
131 (83h)	Flow control	G/S	ENUM USINT	0 = off: data flow control is deactivated 1 = XON/XOFF Software-handshake is activated 2 = RTS/CTS Hardware-handshake is activated 3 = reserved
132 (84h)	Data width	G/S	ENUM USINT	0 = 7 bits 1 = 8 bits
133 (85h)	Parity	G/S	ENUM USINT	0 = none 1 = odd The number of the bits set to 1 is odd (incl. data and parity bit). 2 = even The number of the bits set to 1 is even (incl. data and parity bit).
134 (86h)	Stop bits	G/S	ENUM USINT	Number of the stop bits. 0 = 1 bit 1 = 2 bits

Table 55: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
135 (87h)	XON character	G/S	USINT	XON character This sign is used to start the data transfer to the data terminal equipment (DTE) with the activation of the software handshake. 0 - 255 default: 17/ 11h
136 (88h)	XOFF character	G/S	USINT	XOFF character This sign is used to stop the data transfer to the data terminal equipment (DTE) with the activation of the software handshake. (0 - 255) default: 19/ 13h

5.3.15 RS4xx Module Class (VSC115)

This Class contains all information and parameters for RS485/422 modules.

Note

Please refer to paragraph section "Class instances of the VSC", page 5-25, for the description of the class instance for the VSC.

Object instance

Table 56: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "BL67-1RS485/422".
106 (6Ah)	Module revision number	G	USINT	Contains the revision number of the module firmware.
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: – see attribute 107 (6Bh) on page 5-32
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the BL67 module. ARRAY OF: BYTE: Control byte sequence
109 (6Dh	Module response interface	G	ARRAY	Response interface of the BL67 module. ARRAY OF: BYTE: Response-byte sequence
110 (6Eh)	Module registered Index	G	ENUM USINT	Contains the index numbers specified in all the module lists.

Table 56: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
111 (6Fh)	Number of supported channels	G	USINT	States the number of analog input channels supported by this module Instance.
112 (70h)	RX byte count	G	USINT	Number of the valid bytes (0 to 7) in this data segment.
113 (71h)	RX count	G	USINT	This value is transferred together with every data segment of the process input data. The RX count values are sequential: 00->01->10->11->00.... (decimal: 0->1->2->3->0....) Errors in this sequence show the loss of data segments.
114 (72h)	TX count acknowledge	G	USINT	This value is a copy of the value TX count. TX count has been transmitted together with the last data segment of the process output data. TX count acknowledge is an acknowledge for the successful transmission of the data segment with TRANSMIT count.
115 (73h)	Status	G	BOOL	0 = The communication with the data terminal equipment (DTE) is disturbed. A diagnostic message is generated if the parameter "Diagnostics“ is set to "0/ release“. The diagnostic data show the cause of the communication disturbance. The user has to set back this bit in the process output data by using STATRES. 1 = The communication with the data terminal equipment (DTE) is error free.

Table 56: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
116 (74h)	Process diagnostics data	G	BYTE	Contains the diagnostic information: The diagnostic data are part of the process input data, if ACTIVE MODE = 1 or 2bytes ctrl/status header is set. Diagnostics messages: – Bit 0 to Bit 2: reserved – Bit 3: 0 = ok 1 = parameter error: The set parameter values are not supported. – Bit 4: 0 = ok 1 = hardware failure: The module has to be replaced, e.g. EEPROM or UART may be defect. – Bit 5: 0 = ok 1 = handshake error: The DTE connected to the module does not answer a XOFF or RTS handshake. This may cause a overflow in the internal receive-buffer. – Bit 6: 0 = ok 1 = frame error: The module has to be parameterized to be adapted to the data structure of the connected DTE. A frame error occurs if the parameterization (number of data bits, stop bits, parity) is not correct. – Bit 7: 0 = ok 1 = buffer overflow: Overflow in the RX-buffer. – Bit 8 to Bit 15: reserved
117 (75h)	RX data	G	ARRAY OF BYTE	Defines the receive-data (0...7).
118 (76h)	RX data and release	G	ARRAY OF BYTE	Defines the data received via RS485/422 (0...7) + acknowledge for reception
119 (77h)	TX byte count	G/S	USINT	Number of the valid user data bytes in this data segment. I

Table 56: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
120 (78h)	TX count	G/S	USINT	This value is transferred together with every data segment. The TX count values are sequential: 00->01->10->11->00.... (decimal: 0->1->2->3->0....) Errors in this sequence show the loss of data segments.
121 (79h)	RX count acknowledge	G/S	USINT	This value is a copy of RX count. RX count has been transmitted together with the last data segment of the process input data. RX count acknowledge is an acknowledge for the successful transmission of the data segment with RX count.
122 (7Ah)	Status reset control	G/S	BOOL	STATRES: This bit is set to reset the STAT bit in the process input data. With the change from 1 to 0 the status bit is reset (from 0 to 1). If this bit is 0, all changes in TRANSMIT BYTE count, TRANSMIT count and RECEIVE count acknowledge are ignored. Flushing the transmit-/ receive-buffer with process control data (Attr. 123) is possible. If this bit is 1 or with the change from 0 to 1, the flushing of the transmit-/ receive-buffer with ROCESS control data (Attr. 123) is not possible.
123 (7Bh)	Process control data	G/S	BYTE	Bit 0 = transmit-buffer flush, Bit 1 = receive-buffer flush
124 (7Ch)	TX data	G/S	ARRAY OF BYTE	Defines the transmit-data (0...7)
125 (7Dh)	TX data and release	S	ARRAY OF BYTE	Defines the data to be transmitted via RS485/422 (0...7) + transmission is released/ charged immediately
126 (7Eh)	reserved			

Table 56: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
127 (7Fh)	Diagnostics	G	WORD	Contains the diagnostic messages (low byte): Diagnostics messages: – Bit 0 to Bit 2: reserved – Bit 3: 0 = ok 1 = parameter error: The set parameter values are not supported. – Bit 4: 0 = ok 1 = hardware failure: The module has to be replaced, e.g. EEPROM or UART may be defect. – Bit 5: 0 = ok 1 = handshake error: The DTE connected to the module does not answer a XOFF or RTS handshake. This may cause a overflow in the internal receive-buffer. – Bit 6: 0 = ok 1 = frame error: The module has to be parameterized to be adapted to the data structure of the connected DTE. A frame error occurs if the parameterization (number of data bits, stop bits, parity) is not correct. – Bit 7: 0 = ok 1 = buffer overflow: Overflow in the RX-buffer. – High byte: reserved
128 (80h)	Active mode	G/S	BOOL	0 = 1byte ctrl/status header: The diagnostic data are not part of the process input data, 7 bytes of user data are available. 1 = 2byte ctrl/status header: The diagnostic data are part of the process input data, 6 bytes of user data are available.

Table 56: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
129 (81h)	Bit rate	G/S	ENUM USINT	Used to set the baudrate for the gateway: 0 = reserved, 1 = 300 bps 2 = 600 bps 3 = 1200 bps 4 = 2400 bps 5 = 4800 bps 6 = 9600 bps 7 = 14400 bps 8 = 19200 bps 9 = 28800 bps 10 = 38400 bps 11 = 57600 bps 12 = 115200 bps ... 15 = reserved)
130 (82h)	Disable diagnostics	G/S	BOOL	0 = released: The diagnostic function is activated. 1 = blocked: The diagnostic function is deactivated.
131 (83h)	Flow control	G/S	ENUM USINT	0 = off: data flow control is deactivated 1 = XON/XOFF Software-handshake is activated 2 = RTS/CTS Hardware-handshake is activated 3 = reserved
132 (84h)	Data width	G/S	ENUM USINT	0 = 7 bits 1 = 8 bits
133 (85h)	Parity	G/S	ENUM USINT	0 = none 1 = odd The number of the bits set to 1 is odd (incl. data and parity bit). 2 = even The number of the bits set to 1 is even (incl. data and parity bit).
134 (86h)	Stop bits	G/S	ENUM USINT	Number of the stop bits. 0 = 1 bit 1 = 2 bits

Table 56: Object instance

Attr. No. dec. (hex.)	Attribute name	Get/ Set	Type	Description
135 (87h)	XON character	G/S	USINT	XON character This sign is used to start the data transfer to the data terminal equipment (DTE) with the activation of the software handshake. 0 - 255 default: 17/ 11h
136 (88h)	XOFF character	G/S	USINT	XOFF character This sign is used to stop the data transfer to the data terminal equipment (DTE) with the activation of the software handshake. (0 - 255) default: 19/ 13h
137 (89h)	RSXX Modus	G/S	ENUM USINT	0 = RS422: Parameterization as 422 1 = RS485: Parameterization as 485

5.3.16 SSI Module Class (VSC116)

This Class contains all information and parameters for SSI-modules.

Note

Please refer to paragraph section "Class instances of the VSC", page 5-25, for the description of the class instance for the VSC.

Object instance

Table 57: Object instance

Attr. No. dec. (hex.)	Attribute name	Get/ Set	Type	Description
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "BL67-1SSI".
106 (6Ah)	Module revision number	G	USINT	Contains the revision number of the module firmware.
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: – see attribute 107 (6Bh) on page 5-32
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the BL67 module. ARRAY OF: BYTE: Control byte sequence
109 (6Dh	Module response interface	G	ARRAY	Response interface of the BL67 module. ARRAY OF: BYTE: Response-byte sequence
110 (6Eh)	Module registered Index	G	ENUM USINT	Contains the index numbers specified in all the module lists.

Table 57: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
111 (6Fh)	Number of supported channels	G	USINT	States the number of analog input channels supported by this module Instance.
112 (70h)	Diagnostics and status	G	WORD	Bit 0: 0 = No enabled status signal is active (SSI_STSx = 0). 1 = group diagnostics At least one enabled status signal is active (SSI_STSx = 1).
				Bit 1: 0 = SSI encoder signal present. 1 = SSI error/open circuit SSI encoder signal faulty. (e.g. due to a cable break).
				Bit 2: 0 = A comparison of the register contents has produced the following result: (REG_SSI_POS) ≤ (REG_UPPER_LIMIT) 1 = error POS > UPPER LIMIT A comparison of the register contents has produced the following result: (REG_SSI_POS) > (REG_UPPER_LIMIT)
				Bit 3: 0 = A comparison of the register contents has produced the following result: (REG_SSI_POS) ≥ (REG_LOWER_LIMIT) 1 = error POS < LOWER LIMIT A comparison of the register contents has produced the following result: (REG_SSI_POS) < (REG_LOWER_LIMIT)
				Bit 4 0 = The parameter set of the module has been accepted. 1 = parameterization error Operation of the module is not possible with the present parameter set.
				Bit 5 to 6 <reserved>
				Bit 7 0 = The SSI encoder is read cyclically. 1 = SSI communication suspended Communication with the SSI encoder is stopped as STOP = 1 (process output) or ERR_PARA = 1.

Table 57: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
112 (70h)	Diagnostics and status	G	WORD	Bit 8 0 = A comparison of the register contents has produced the following result: (REG_SSI_POS) ≠ (REG_CMP1) 1 = CMP1 register value matches POS A comparison of the register contents has produced the following result: (REG_ SSI_POS) = (REG_CMP1)
				Bit 9 0 = Default status, i.e. the register contents have not yet matched (REG_SSI_POS) = (REG_CMP1) since the last reset. 1= CMP1 flag set The contents of the registers match: (REG_SSI_POS) = (REG_CMP1). This marker must be reset with bit 9 of the control attribute.
				Bit 10 0 = A comparison of the register contents has produced the following result: (REG_SSI_POS) < (REG_CMP1) 1 = POS ≥ CMP1 register value A comparison of the register contents has produced the following result: (REG_ SSI_POS) ≥ (REG_CMP1)
				Bit 11 0 = A comparison of the register contents has produced the following result: (REG_SSI_POS) ≠ (REG_CMP2) 1 = CMP2 register value matches POS A comparison of the register contents has produced the following result: (REG_ SSI_POS) = (REG_CMP29
				Bit 12 0 = Default status, i.e. the register contents have not yet matched (REG_SSI_POS) = (REG_CMP2) since the last reset. 1 = CMP2 flag set The contents of the registers match: (REG_SSI_POS) = (REG_CMP2). This marker must be reset with bit 12 of the control attribute.

Table 57: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
112 (70h)	Diagnostics and status	G	WORD	Bit 13 0 = A comparison of the register contents has produced the following result: (REG_SSI_POS) < (REG_CMP2) 1 = POS ≥ CMP2 register value. A comparison of the register contents has produced the following result: (REG_SSI_POS) ≥ (REG_CMP2)
				Bit 14 0 = The SSI encoder values are incremented or the values are constant. 1 = counting downwards The SSI encoder values are decremented.
				Bit 15 0 = The SSI encoder values are decremented or the values are constant. 1 = counting upwards The SSI encoder values are incremented.
113 (71h)	Result write operation	G	WORD	Bit 0 to 5 <reserved>
				Bit 6: 0 = No modification of the data in the register bank by process output, i.e. "Write operation" = 0. A write job would be accepted with the next telegram of process output data. (handshake for data transmission to the register.) 1 = control register write acknowledged A modification of the register contents by a process output was initiated, i.e. "Write operation" = 1. A write job would not be accepted with the next telegram of process output data.
				Bit 7: 0 = The writing of user data for process output to the register addressed with "Address write register" in the process output data could not be executed. 1 = control register write accepted The writing of user data for process output to the register addressed with "Address write register" in the process output data could be executed successfully.

Table 57: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
114 (72h)	Result in read operation	G	BYTE	Bit 0 to 6: <reserved>
				Bit 7: 0 = The reading of the register stated in "Address read register" was accepted and executed. The content of the register is located in "Value read register". 1 = register read operation aborted The reading of the register stated in "Address read register" was not accepted. "Value read register" is zero.
115 (73x)	Address read register	G	UINT	Address of the input register with contents stated in "Value read register" when "Result read operation“ = 0.
116 (74h)	Value read register	G	DWORD	Content of the register to be read if "Result read operation“= 0. If "Result read operation“ = 1, "Value read register" = 0.
117 (75h)	Control	G/S	WORD	Bit 0 to 6: <reserved>
				Bit 7: 0 = Request to read the SSI encoder cyclically 1 = suspend communication requested Request to interrupt communication with the encoder
				Bit 8: 0 = Default status, i.e. the data bits 8 to 10 of the “Diagnostics and status“ attribute always have the value 0, irrespective of the actual SSI encoder value. 1 = compare/flag CMP1 active Comparison active, i.e. the data bits 8 to 10 of the “Diagnostics and status“ attribute always have a value based on the result of the comparison with the actual SSI encoder value.
				Bit 9: 0 = Default status, i.e. reset of Bit 9 of the “Diagnostics and status“ attribute not active. 1 = clear CMP1 flag Reset of bit 9 of the “Diagnostics and status“ attribute active.
				Bit 10: <reserved>

Table 57: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
117 (75h)	Control	G/S	WORD	Bit 11: 0 = Default status, i.e. the data bits 11 to 13 of the “Diagnostics and status“ attribute always have the value 0, irrespective of the actual SSI encoder value. 1 = compare/flag CMP2 active Comparison active, i.e. the data bits 11 to 13 of the “Diagnostics and status“ attribute always have a value based on the result of the comparison with the actual SSI encoder value.
				Bit 12: 0 = Default status, i.e. no reset of Bit 12 of the “Diagnostics and status“ attribute active. 1 = clear CMP2 flag Reset of bit 12 of the “Diagnostics and status“ attribute active.
				Bit 13 to 15: <reserved>
118 (76h)	Address read register	G/S	UINT	Address of the register with contents stated in "Value read register" when "Result read operation“ 7 = 0.
119 (77h)	Address write register	G/S	UINT	Address of the register to be written with "Value write register".
120 (78h)	Value write register	G/S	DWORD	Value to be written to the register with the address stated at "Address write register".
121 (79h)	Write operation	G/S	BOOL	0 = Default status, i.e. there is no request to overwrite the content of the register address stated at "Address write register" with "Value write register". Bit 6 of the "Result write operation“" attribute is reset (=0) if necessary. 1 = Request to overwrite the content of the register at the address "Address write register" with "Value write register".
122 (7Ah)	Write register and execute	S	STRUCT OF UINT DWORD	The structure contains both parts: – Address of the register to be written. – Value to be written. The write operation is executed without checking whether a write job is already present.

Table 57: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
123 (7Bh)	Diagnostics	G	WORD	Bit 0: 0 = No enabled status signal is active (SSI_STSx = 0). 1 = group diagnostics At least one enabled status signal is active (SSI_STSx = 1).
				Bit 1: 0 = SSI encoder signal present. 1 = SSI error/open circuit SSI encoder signal faulty. (e.g. due to a cable break).
				Bit 2: 0 = A comparison of the register contents has produced the following result: (REG_SSI_POS) ≤ (REG_UPPER_LIMIT) 1 = error POS > UPPER LIMIT A comparison of the register contents has produced the following result: (REG_SSI_POS) > (REG_UPPER_LIMIT)
				Bit 3: 0 = A comparison of the register contents has produced the following result: (REG_SSI_POS) ≥ (REG_LOWER_LIMIT) 1 = error POS < LOWER LIMIT A comparison of the register contents has produced the following result: (REG_SSI_POS) < (REG_LOWER_LIMIT)
				Bit 4: 0 = The parameter set of the module has been accepted. 1 = parameterization error Operation of the module is not possible with the present parameter set.
				Bit 5 to 15 <reserved>
124 (7Ch)	Check mode	G/S	WORD	Bit 0 to 4 <reserved>
				Bit 5: 0 = ZERO test of data cable. 1 = disable SSI error detection After the last valid bit, a ZERO test of the data cable is not carried out.
				Bit 6 to 15 <reserved>

Table 57: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
125 (7Dh)	Invalid bits LSB	G/S	USINT	Number of invalid bits on the LSB side of the position value supplied by the SSI encoder. The meaningful word width of the position value transferred to the module bus master is as follows: FRAME LENGTH - INVALID BITS MSB - INVALID BITS LSB. The invalid bits on the LSB side are removed by shifting the position value to the right, starting with the LSB. (Default 0 Bit = 0_{hex}). INVALID BITS MSB + INVALID BITS LSB must always be less than FRAME LENGTH.
126 (7Eh)	Bit rate		ENUM USINT	0 = 1 Mbps 1 = 500 kbps 2 = 250 kbps 3 = 100 kbps 4 = 125 kbps 5 = 83 kbps 6 = 71 kbps 7 = 62.5 kbps 8 to 15 <reserved>
128 (80h)	Frame length	G/S	USINT	Number of bits of the SSI data frame. FRAME LENGTH must always be greater than INVALID_BITS. **A** Default: 25 = 19_{hex}
129 (81h)	Kind of coding SSI	G/S	BOOL	0 = Binary code 1 = GRAY code
130 (82h)	Invalid bits MSB	G/S	USINT	Number of invalid bits on the MSB side of the position value supplied by the SSI encoder. The meaningful word width of the position value transferred to the module bus master is as follows: FRAME LENGTH - INVALID BITS MSB - INVALID BITS LSB. The invalid bits on the MSB side are zeroed by masking the position value. I NVALID BITS MSB + INVALID BITS LSB must always be less than FRAME LENGTH. Default: 0 = 0_{hex}

5.3.17 Digital Versatile Module Class (VSC117)

This class contains all information and parameters for digital versatile modules.

Attention

In this class, chosen parameter options can only be deactivated by activating another option of this parameter.

Note

Please refer to paragraph section "Class instances of the VSC", page 5-25, for the description of the class instance for the VSC.

Oject Instance

Table 58: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "BL67-4DO-0.5A-P".
106 (6Ah)	Module revision	G	USINT	Contains the revision number of the module firmware.
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: – see attribute 107 (6Bh) on page 5-32
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the BL67 module. ARRAY OF: BYTE: Control byte sequence

Table 58: Object instance

Attr. No. dec. (hex.)	Attribute name	Get/ Set	Type	Description
109 (6Dh)	Module response interface	G	ARRAY	Response interface of the BL67 module. ARRAY OF: BYTE: Response byte sequence
110 (6Eh)	Module registered Index	G	ENUM USINT	Contains the index numbers specified in all the module lists.
111 (6Fh)	Module input channel count	G	USINT	Contains the number of input channels supported by the module.
112 (70h)	Module output Channel count	G	USINT	Contains the number of output channels supported by the module.
Input data				
113 (71h)	Module input_1	G	DWORD	Input data of the module (according to channels).
114 (72h)	Module input_2	G	DWORD	Input data of the module (according to channels).
Output data				
115 (73h)	Module output_1	G	DWORD	Output data of the module (according to channels).
116 (74h)	Module output _2	G	DWORD	Output data of the module (according to channels).
Diagnosis data				
117 (75h)	Open circuit error_1	G	DWORD	This attribute contains diagnosis information about open circuit errors (according to channels).
118 (76h)	Open circuit error_2	G	DWORD	This attribute contains diagnosis information about open circuit errors (according to channels).
119 (77h)	Short circuit output error_1	G	DWORD	This attribute contains diagnosis information about output short-circuits (according to channels).
120 (78h)	Short circuit output error_2	G	DWORD	This attribute contains diagnosis information about output short-circuits (according to channels).
121 (79h)	Short circuit sensor error_1	G	DWORD	This attribute contains diagnosis information about sensor short-circuits (according to channels).

Table 58: Object instance

Attr. No. dec. (hex.)	Attribute name	Get/ Set	Type	Description
122 (7Ah)	Short circuit sensor error_2	G	DWORD	This attribute contains diagnosis information about sensor short-circuits (according to channels).
123 (7Bh)	Cable error_1	G	DWORD	This attribute contains open-circuit diagnosis information (channel 1 to 32).
124 (7Ch)	Cable error_2	G	DWORD	This attribute contains open-circuit diagnosis (channel 33 to 64).
Parameter data				
125 (7Dh)	Open circuit monitoring mode_1	G/S	DWORD	Enables the open-circuit monitoring (channel 1 to 32).
126 (7Eh)	Open circuit monitoring mode_2	G/S	DWORD	Enables the open-circuit monitoring (channel 33 to 64).
127 (7Fh)	Invert input data_1	G/S	DWORD	The input signal is inverted (channel 1 to 32).
128 (80h)	Invert input data_2	G/S	DWORD	The input signal is inverted (channel 33 to 64).
129 (81h)	Invert output data_1	G/S	DWORD	The output signal is inverted (channel 1 to 32).
130 (82h)	Invert output data_2	G/S	DWORD	The output signal is inverted (channel 33 to 64).
131 (83h)	reserved	-	-	-
132 (84h)	reserved	-	-	-
133 (85h)	Auto recovery output_1	G/S	DWORD	The outputs switch on automatically after an overload.
134 (86h)	Auto recovery output_2	G/S	DWORD	The outputs switch on automatically after an overload.
135 (87h)	reserved	-	-	-
136 (88h)	reserved	-	-	-
137 (89h)	Retriggered recovery output_1	G/S	DWORD	The outputs (channel 1 to 32) have to be retriggered in case of an overload.

Table 58: Object instance

Attr. No. dec. (hex.)	Attribute name	Get/ Set	Type	Description
138 (8Ah)	Retriggered recovery output_2	G/S	DWORD	The outputs (channel 33 to 64) have to be retriggered in case of an overload.
139 (8Bh)	Enable high side output driver_1	G/S	DWORD	Enables the high side output driver of channels (channel 1 to 32).
140 (8Ch)	Enable high side output driver_2	G/S	DWORD	Enables the high side output driver of channels (channel 33 to 64).
141 (8Dh)	Enable low side output driver_1	G/S	DWORD	Enables the low side output driver of channels (channel 1 to 32).
142 (8Eh)	Enable low side output driver_2	G/S	DWORD	Enables the low side output driver of channels (channel 33 to 64).
143 (8Fh)	Filter 2500µs Channel 1	G/S	DWORD	Enables the input filter of the channel (channel 1 to 32).
144 (90h)	Filter 2500µs Channel 2	G/S	DWORD	Enables the input filter of the channel (channel 33 to 64).
145 (91h)	Fault value	G/S	DWORD	Activates the fault value for the channel (channel 1 to 32).
146 (92h)	Fault value	G/S	DWORD	Activates the fault value for the channel (channel 33 to 64).
147 (93h)	Block diagnostics	G/S	DWORD	Channel specific diagnostic information is blocked (channel 1 to 32).
148 (94h)	Block diagnostics	G/S	DWORD	Channel specific diagnostic information is blocked (channel 33 to 64).

5.3.18 Analog Versatile Module Class (VSC118)

This class contains all information and parameters for analog versatile modules.

Attention

In this class, chosen parameter options can only be deactivated by activating another option of this parameter.

Note

Please refer to paragraph section "Class instances of the VSC", page 5-25, for the description of the class instance for the VSC.

Object instance

Table 59: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "BL67-4DO-0.5A-P".
106 (6Ah)	Module revision	G	USINT	Contains the revision number of the module firmware.
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: – see attribute 107 (6Bh) on page 5-32
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the BL67 module. ARRAY OF: BYTE: Control byte sequence

Table 59: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
109 (6Dh)	Module response interface	G	ARRAY	Response interface of the BL67 module. ARRAY OF: BYTE: Response byte sequence
110 (6Eh)	Module registered index	G	ENUM USINT	Contains the index numbers specified in all the module lists.
111 (6Fh)	Module input channel count	G	USINT	Contains the number of input channels supported by the module.
112 (70h)	Module output Channel count	G	USINT	Contains the number of output channels supported by the module.
Input data				
113 (71h)	Channel_1	G	UINT	Input data of the module, channel 1.
...				
128 (80h)	Channel_16	G	UINT	Input data of the module, channel 16.
129 (81h) to 144 (90h)	reserved	G	UINT	Output data of the module.
Diagnosis data				
145 (91h)	Range error	G	WORD	This attribute contains diagnosis information errors in the measurement value range (according to channels).
146 (92h)	Open circuit error	G	WORD	This attribute contains diagnosis information about open circuit errors (according to channels).
147 (93h)	Short circuit output error	G	DWORD	This attribute contains diagnosis information about output short-circuits (according to channels).
148 (94h)	reserved			
149 (95h) to 164 (A4h)	reserved			

Table 59: Object instance

Attr. No. dec. (hex.)	Attribute name	Get/ Set	Type	Description
Parameter data				
165 (A5h)	Operating mode_ channel 1	G/S	ENUM USINT	Parameter for setting the operating mode of the respective channel: 0 = deactivate channel 1 = -10 V...+10 V 2 = 0 V...+10 V 3 = 0 mA...20 mA 4 = 4 mA...20 mA
...				
180 (B4h)	Operating mode_ channel 16	G/S	ENUM USINT	
181 (B5h)	Representation mode _channel_1	G/S	ENUM USINT	Parameter for setting the type of value representation for the respective channel: 0 = default 1 = 16 bit integer 2 = 12 bit left justified + diagnostics
...				
196 (C4h)	Representation mode _channel_16			
197 (C5h)	Block diagnostics	G/S	WORD	Channel specific diagnostic information is blocked.

5.3.19 CVI Module Class (VSC119)

This class contains all information and parameters for the modules BL67-1CVI.

Attention

In this class, chosen parameter options can only be deactivated by activating another option of this parameter.

Note

Please refer to paragraph section "Class instances of the VSC“, page 5-25, for the description of the class instance for the VSC.

Object instance

Table 60: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "BL67-4DO-0.5A-P".
106 (6Ah)	Module revision	G	USINT	Contains the revision number of the module firmware.
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: – see attribute 107 (6Bh) on page 5-32
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the BL67 module. ARRAY OF: BYTE: Control byte sequence

Table 60: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
109 (6Dh)	Module response interface	G	ARRAY	Response interface of the BL67 module. ARRAY OF: BYTE: Response byte sequence
110 (6Eh)	Module registered Index	G	ENUM USINT	Contains the index numbers specified in all the module lists.
111 (6Fh)	Module input channel count	G	USINT	Contains the number of input channels supported by the module.
112 (70h)	Module output Channel count	G	USINT	Contains the number of output channels supported by the module.
Input data				
113 (71h)	Module input_1	G	DWORD	Input data of the module (according to channels).
114 (72h)	Module input_2	G	DWORD	Input data of the module (according to channels).
Output data				
115 (73h)	Module output_1	G	DWORD	Output data of the module (according to channels).
116 (74h)	Module output _2	G	DWORD	Output data of the module (according to channels).
Diagnosis data				
117 (75h)	Common error	G	BYTE	This attribute contains diagnosis information about common errors of the module.
118 (76h)	Valve node_1 error	G	BYTE	This attribute contains diagnosis information about errors of the connected node no. 1.
...	...			
125 (7Dh)	Valve node_8 error	G	BYTE	This attribute contains diagnosis information about errors of the connected node no. 8.
Parameter data				
126 (7Eh)	Guard time	G/S	USINT	Setting the Guard-Time in steps of 100 ms (value 0 to 255); default 3 = 300 ms
127 (7Fh)	Life time factor	G/S	USINT	Factor which defines how often a node is allowed not to answer a request or to exceed the Guard-Time (values 0 to 255); default = 3

Table 60: Object instance

Attr. No. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
128 (80h)	CANopen baudrate	G/S	ENUM USINT	Setting the baudrate for CANopen: 0 = 1000k 1 = reserved 2 = 500k 3 = 250k 4 = 125k **A** 5 = 50k 6 = 20k 7 = 10k
129 (81h)	reserved	-	-	-
130 (81h)	Common config	G/S	DWORD	Activation of the bus terminating resistor: 0 = no terminating resistor **A** 1 = terminating resistor active
131 (82h)	Node_1 output length	G/S	USINT	Defines the length of the output data of the respective node: 0 = 0 bit 1 = 4 bit 2 = 8 bit 3 = 12 bit 4 = 16 bit 5 = 24 bit 6 = 32 bit
...				
138 (8Ah)	Node_8 output length	G/S	USINT	
139 (8Bh)	Node_1 input length	G/S	USINT	Defines the length of the input data of the respective node: 0 = 0 bit 1 = 4 bit 2 = 8 bit 3 = 12 bit 4 = 16 bit 5 = 24 bit 6 = 32 bit
...				
146 (92h)	Node_8 input length	G/S	USINT	
147 (93h)	Guarding	G/S	BYTE	Activates the node guarding (according to channels).
148 (94h)	Activation	G/S	BYTE	Node activation (according to channels).

5.3.20 RFID-S module class (VSC124)

This class contains all information and parameters for the modules BL20-2RFID-S.

Attention

In this class, chosen parameter options can only be deactivated by activating another option of this parameter.

Note

Please refer to paragraph section "Class instances of the VSC", page 5-25, for the description of the class instances for VSC.

Object Instance

Note

The object instances of VSC 124 represent the individual RFID-S channels, not the complete modules!

Tabelle 61: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = electronics module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "BL20-2RFID-S".
106 (6Ah)	Module revision	G	USINT	Contains the revision number of the module firmware.
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: see attribute 107 (6Bh) on page 5-32
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the module. ARRAY OF: BYTE: Control byte sequence

Tabelle 61: Object instance

Attr. no. dec. (hex.)	Attribute name	Get/ Set	Type	Description
109 (6Dh)	Module response interface	G	ARRAY	Response interface of the module. ARRAY OF: BYTE: Response byte sequence
110 (6Eh)	Diag size	G	UINT	Indicates the number of diagnostic bits of the module.
111 (6Fh)	Diag	G	WORD	Contains the diagnostic information of the module. WORD: Bit for bit assignment according to module specification.
112 (70h)	Module registered index	G	ENUM USINT	Contains the index numbers specified in all the module lists.
113 (71h)	Module output data	G	ARRY OF BYTE	Process data output information.
114 (72h)	Module input data	G	ARRY OF BYTE	Process data input information.
115 (73h)	Bypass time channel 1	G/S	WORD	Bypass time in ms
116 (74h)	Bypass time channel 2	G/S	WORD	Bypass time in ms

Note

For further information concerning the RFID communication interfaces see the special RFID documentation which can be downloaded from www.turck.com.

6 Application example: BL67 gateway at Allen Bradley PLC

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6.1 General

The following example shows detailed information about the connection of a BL67 station for EtherNet/IP to an Allen Bradley PLC.

6.1.1 Prerequisites for this example

In order to configure BL67 devices and to build up communications with the Allen Bradley ControlLogix PLC over EtherNet/IP, the following software tools and hardware devices are necessary.

Software:

- RSLinX - used to establish communication over EtherNet/IP
- RSLogix 5000 - used to configure the controller and the other network hosts

Hardware used in this example:

- Allen Bradley PLC 1756-L55/ A 1756-M12/A LOGIX5555,
- Ethernet Bridge 1756-ENBT/A
- BL67 station with a gateway BL67-GW-EN-IP with EtherNet/IP protocol

Example station

The following station is used in this application example:

Table 62: Example station

Module		Data width		
		Process input	Process output	Alignment
GW	BL67-GW-EN-IP			
0	BL67-2AI-I	2 words	-	word by word
1	BL67-4DI-P	4 bits	-	bit by bit
2	BL67-8DI-PD	8 bits	-	bit by bit
3	BL67-2AI-TC	2 words	-	word by word
4	BL67-8XSG-PD	8 bits	8 bits	bit by bit
5	BL67-4DI-PD	4 bits	-	bit by bit
6	BL67-8DI-P	8 bits	-	bit by bit
7	BL67-8DO-0.5A-P	-	8 bits	bit by bit
8	BL67-2AO-V	-	2 words	word by word
9	BL67-2AI-I	2 words	-	word by word
10	BL67-1RS232	4 words	4 words	word by word

6.2 Network configuration

The BL67 gateways are delivered with the default IP address **192.168.1.xxx**.

Note

In order to build up the communication between the BL67 gateway and a PLC/ PC or a network interface card, both devices have to be hosts in the same network.

To achieve this, you have whether

- to adjust the gateway's IP address via BootP, DHCP etc. for integrating it into your own network (for detailed information about the different possibilities for address setting, please read, chapter 4, Address setting for EtherNet/IP, page 4-11.

  or

- to change the IP address of the used PC or network interface card (for detailed information, please read the following section "Changing the IP address of a PC/ network interface card", page 6-4).

6.3 Changing the IP address of a PC/ network interface card

6.3.1 Changing the IP address in Windows 2000/ Windows XP

The IP address is changed in the "Control Panel" in "Network and Dial-up Connections":

1. Open the folder "Local Area Connection" and open the dialog "Local Area Connection Properties" via the button "Properties" in the dialog "Local Area Connection Status".
2. Mark "Internet Protocol (TCP/IP)" and press the "Properties"-button to open the dialog "Internet Protocol (TCP/IP) Properties".

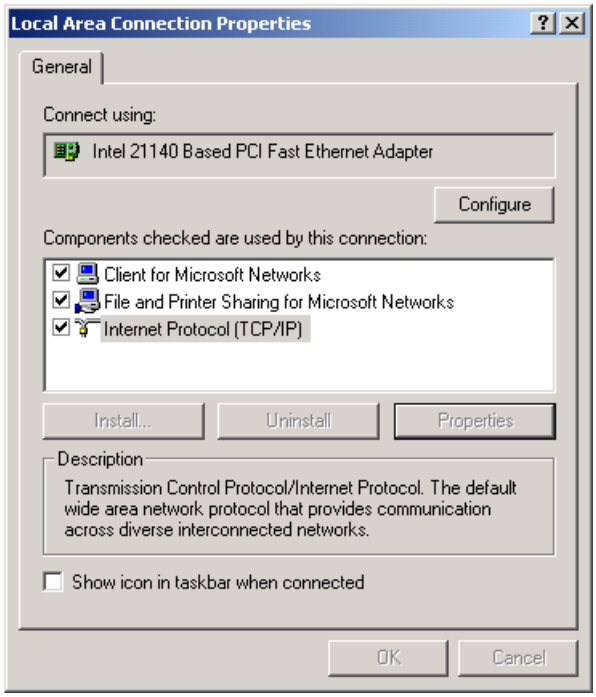
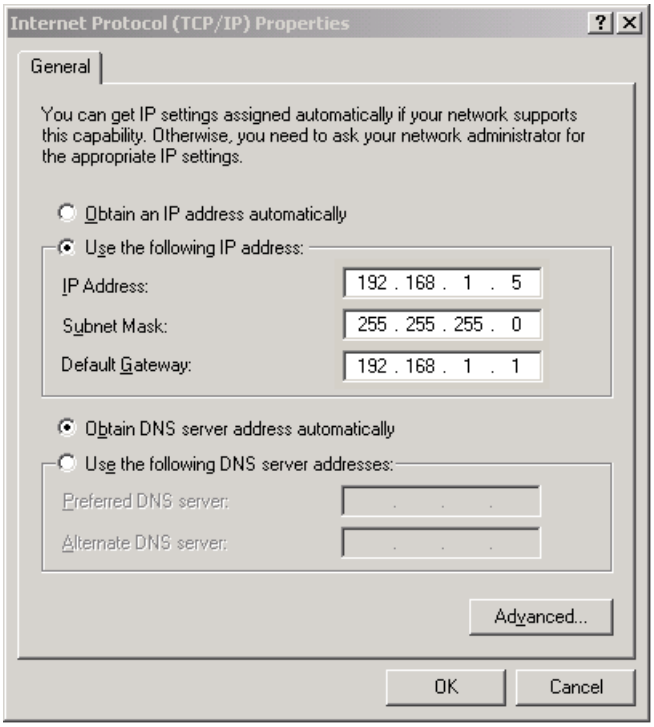


Figure 30: Local Area Connection Properties

3 Activate "Use the following IP address" and assign an IP address of the network mentioned above to the PC/ Network interface card (see the following figure).

Figure 31: Changing the PC's IP address

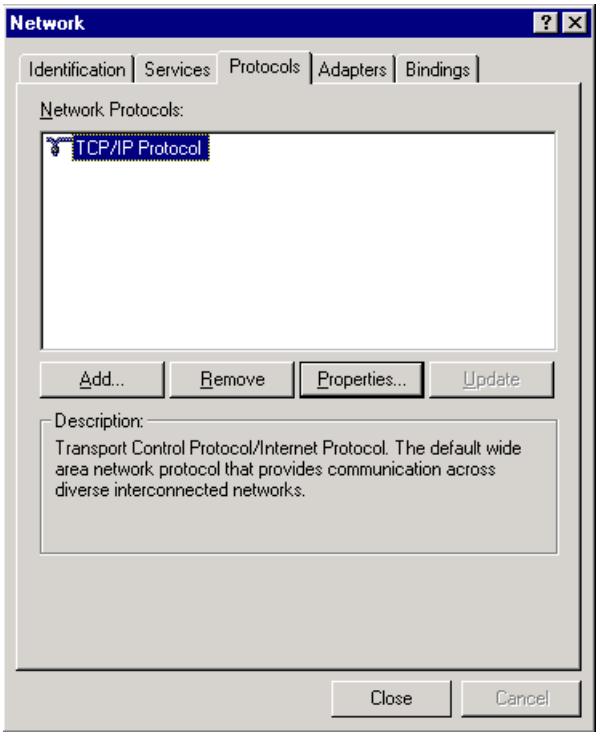

Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP Address:
192 . 168 . 1 . 5
Subnet Mask:
255 . 255 . 255 . 0
Default Gateway:
192 . 168 . 1 . 1
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

6.3.2 Changing the IP address in Windows NT

1 Open the folder "Network" in the Control Panel.

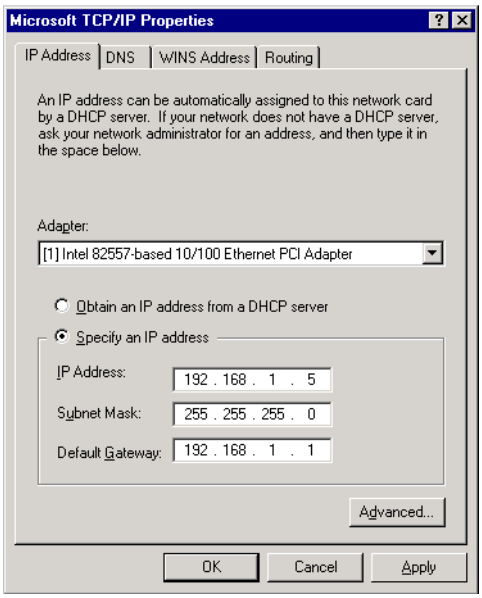
2 Activate TCP/IP connection in the tab "Protocols" and click the "Properties" button.

Figure 32: Network configuration WIN NT



3 Activate "Specify IP address " and set the address as follows.

Figure 33: Specify IP address

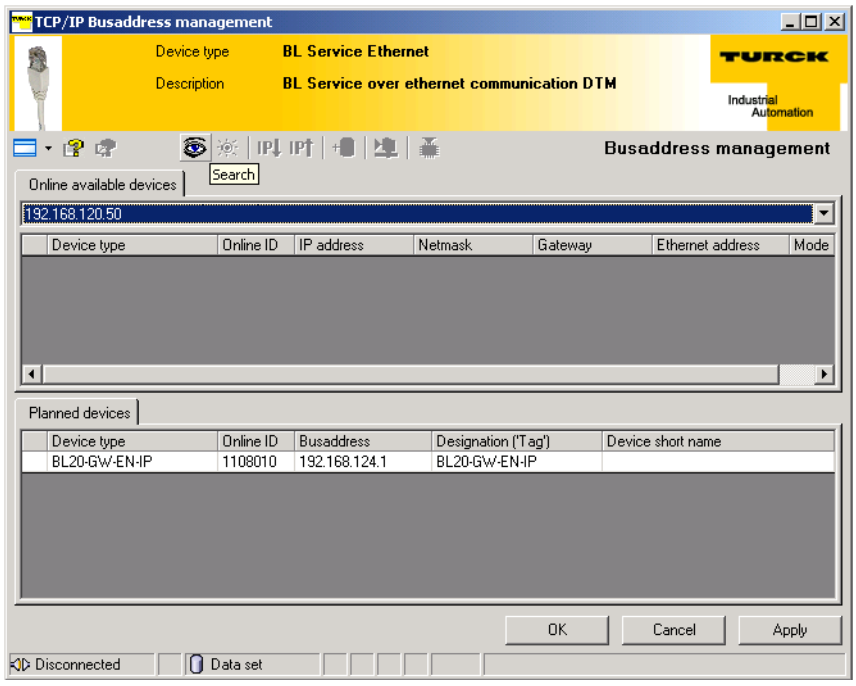

Microsoft TCP/IP Properties
IP Address
DNS
WINS Address
Routing
An IP address can be automatically assigned to this network card by a DHCP server. If your network does not have a DHCP server, ask your network administrator for an address, and then type it in the space below.
Adapter:
[1] Intel 82557-based 10/100 Ethernet PCI Adapter
Obtain an IP address from a DHCP server
Specify an IP address
IP Address:
192 . 168 . 1 . 5
Subnet Mask:
255 . 255 . 255 . 0
Default Gateway:
192 . 168 . 1 . 1
Advanced...
OK
Cancel
Apply

6.3.3 Changing the IP address via I/O-ASSISTANT V3

The Busaddress Management DTM in the software I/O-ASSISTANT offers the possibility to browse the whole Ethernet network for connected nodes and to change their IP address as well as the subnet mask according to the application.

Select the used network card under "Online available devices"and browse the connected network by pressing the search button.

Figure 34: Busaddress Management in the I/O-ASSISTANT



Attention

If Windows XP is used as operating system, problems with the system internal firewall may occur.

It may eventually inhibit the access of the I/O-ASSISTANT to the Ethernet. Please adapt your firewall settings accordingly or deactivate it completely (see also Deactivating/ adapting the firewall in Windows XP, page 6-9).

The network is browsed for connected nodes which are then listed in the Busaddress Management.

It is now possible to change the address settings for all nodes in the list or only for the selected one.

Mark the selected node, enter a new IP address and apply this address by confirming the changes using the "Apply" button.

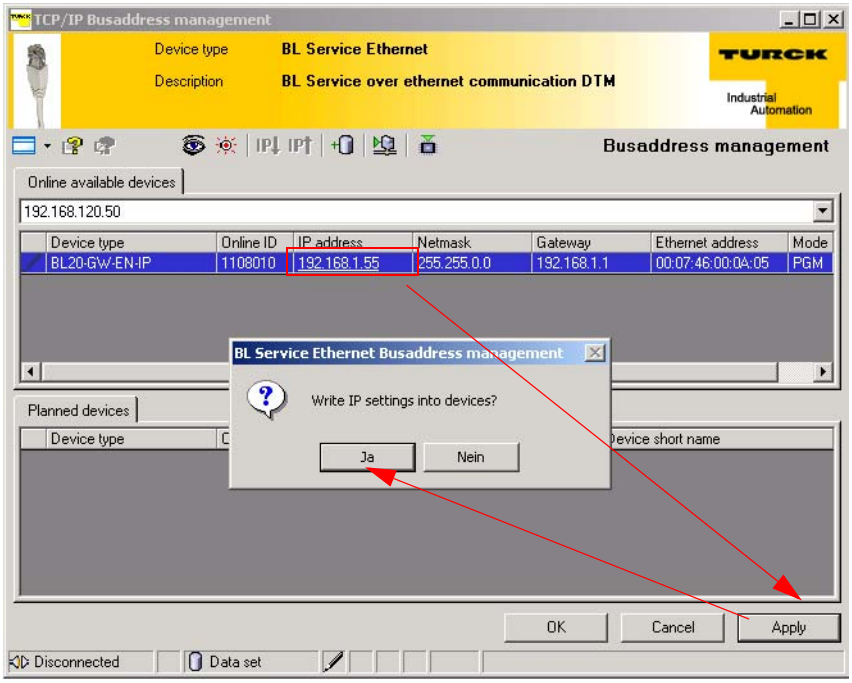


Figure 35: Address changing for selected nodes

Note

For further information about the I/O-ASSISTANT, it's functions and it's handling, please read the online help of the software.

Deactivating/ adapting the firewall in Windows XP

If you use Windows XP as operating system, problems may occur when changing the IP addresses via the I/O-ASSISTANT.

In this case, you can deactivate the system integrated Windows XP firewall completely or adapt it to your application.

- **Deactivating the firewall**
  Open the "Windows Firewall" dialog in the control panel of your PC and deactivate it as follows:

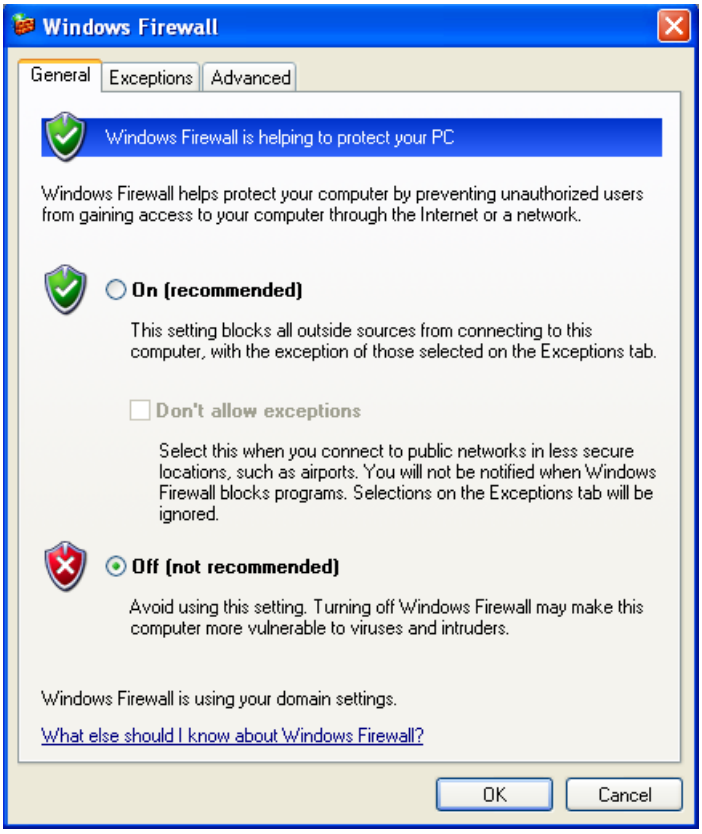
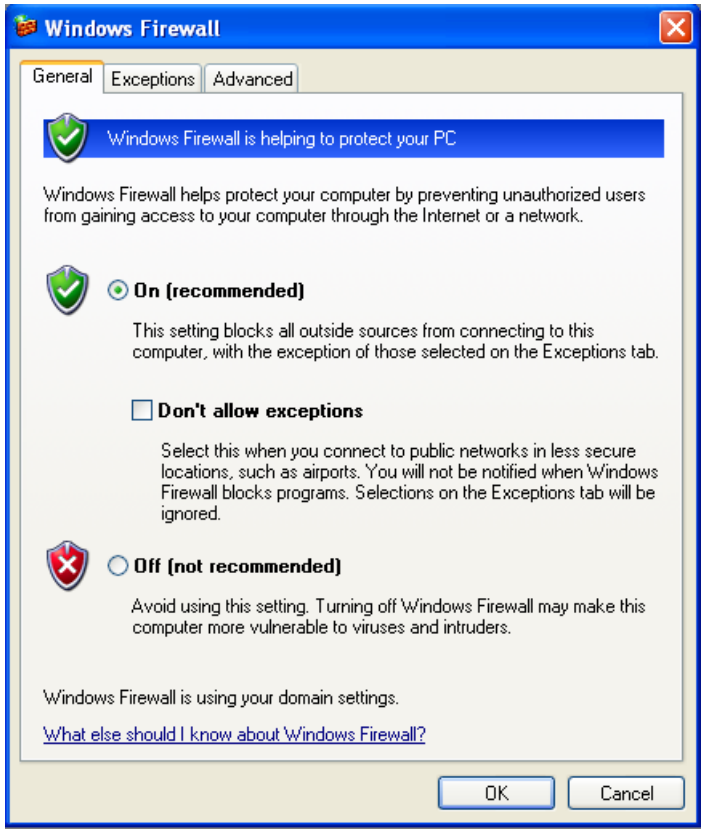

Windows Firewall
General
Exceptions
Advanced
Windows Firewall is helping to protect your PC
Windows Firewall helps protect your computer by preventing unauthorized users from gaining access to your computer through the Internet or a network.
On (recommended)
This setting blocks all outside sources from connecting to this computer, with the exception of those selected on the Exceptions tab.
Don't allow exceptions
Select this when you connect to public networks in less secure locations, such as airports. You will not be notified when Windows Firewall blocks programs. Selections on the Exceptions tab will be ignored.
Off (not recommended)
Avoid using this setting. Turning off Windows Firewall may make this computer more vulnerable to viruses and intruders.
Windows Firewall is using your domain settings.
What else should I know about Windows Firewall?
OK
Cancel

Figure 36: Deactivating the Windows firewall

- **Adapting the firewall**
  The firewall remains active, the option "Don't allow exceptions" it deactivated:

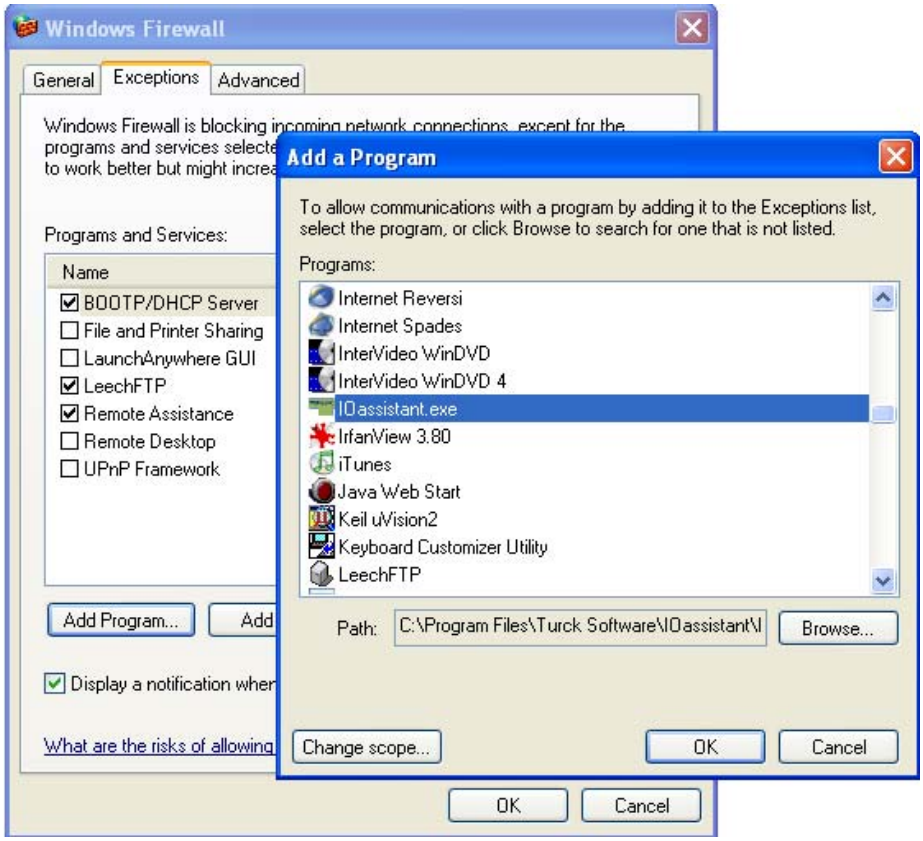
Figure 37: Activating the Windows firewall


Windows Firewall
General
Exceptions
Advanced
Windows Firewall is helping to protect your PC
Windows Firewall helps protect your computer by preventing unauthorized users from gaining access to your computer through the Internet or a network.
On (recommended)
This setting blocks all outside sources from connecting to this computer, with the exception of those selected on the Exceptions tab.
Don't allow exceptions
Select this when you connect to public networks in less secure locations, such as airports. You will not be notified when Windows Firewall blocks programs. Selections on the Exceptions tab will be ignored.
Off (not recommended)
Avoid using this setting. Turning off Windows Firewall may make this computer more vulnerable to viruses and intruders.
Windows Firewall is using your domain settings.
What else should I know about Windows Firewall?
OK
Cancel

- In the "Exceptions"-tab, add the I/O-ASSISTANT to "Programs and Services".
- Pressing the button "Add Program..." opens the dialog "Add a Program". Select the I/O-ASSISTANT from the list of installed programs.

- If necessary, use the button "Browse..." to choose the file "IOassistant.exe" from the installation directory of the software.

Figure 38: "Exceptions"-tab



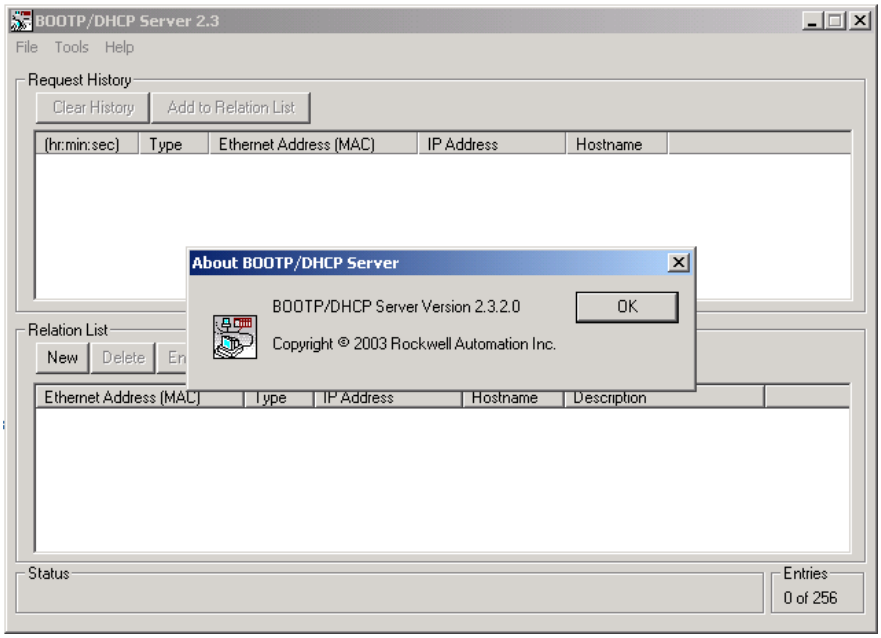
- Despite an active firewall, the I/O-ASSISTANT is now able to browse the network for hosts and the address changing via the software is possible for the connected nodes.

6.4 Address setting at the gateway

6.4.1 Address setting via DHCP-mode

In this application example, the IP address is set via DHCP using the software tool "BootP/DHCP-Server" version 2.3.2.0 from Rockwell Automation.

Figure 39: BootP-Server from Rockwell Automation



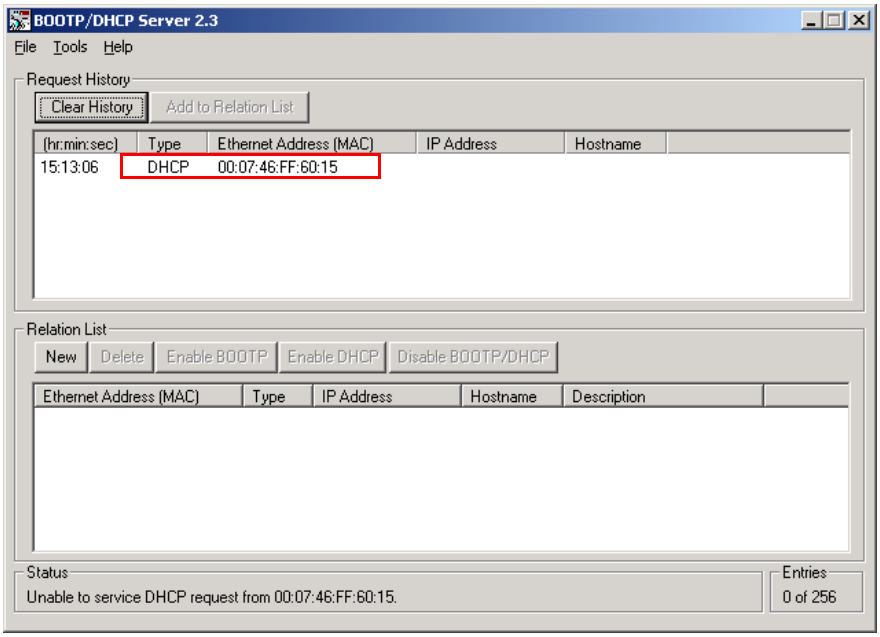
Addresses in the range from 1 to 254 can be allocated in the examplary default subnet 192.168.1. The addresses 0 and 255 are reserved for broadcast messages in the subnet.

Note

The rotary coding switches on the gateway must be set to "400" or "600" in order to enable the DHCP-Mode or respectively the PGM-DHCP-mode.

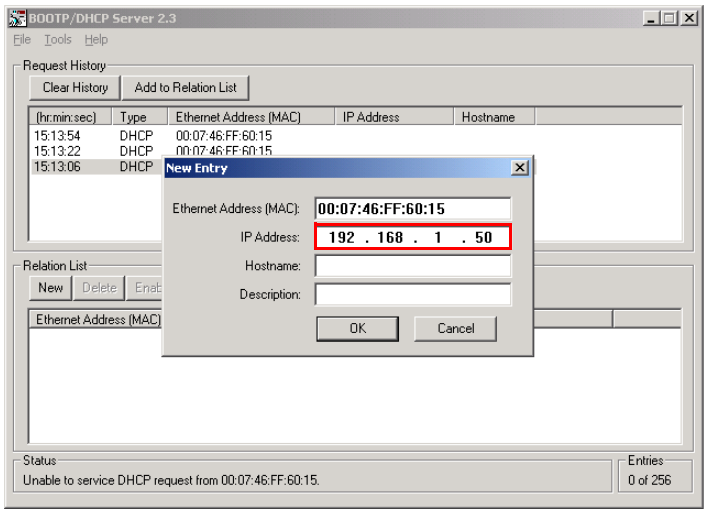
After having been connected to the network, the BL67 sends DHCP requests to the server using its MAC-ID.

Figure 40: DHCP-request of BL67 gateway



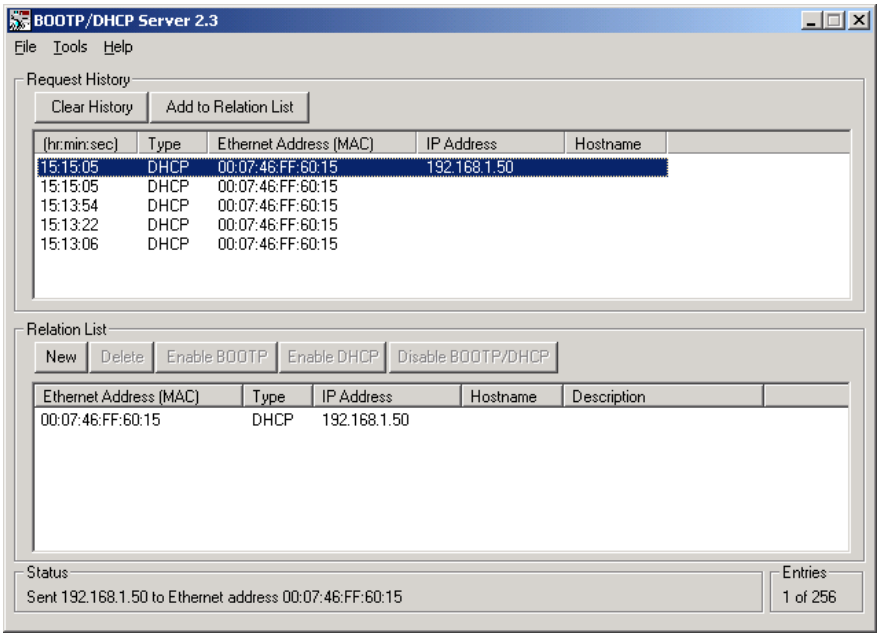
A double click on the request-entry opens the "New Entry" dialog box in which an IP address can be assigned to the module's
MAC-ID.

Figure 41: Setting the IP address via DHCP



The BootP/DHCP-Server sends the IP Address via BootP/DHCP to the BL67 gateway and, after a few seconds, the gateway answers with its new IP address when having stored it.

Figure 42: Setting the IP address via DHCP



The "Relation list" can be stored for further applications. It can serve for permanent assignment of defined IP addresses to MAC-IDs/ modules.

Attention

If the BootP/DHCP-server is shut down, the BL67 gateway loses the IP address after a power reset!

6.5 Setting-up communications with the software tool "RSLinx"

Before the EtherNet/IP network can be configured, access to EtherNet/IP must be established using the software "RSLinx" (version 2.43.01) from Rockwell Automation.

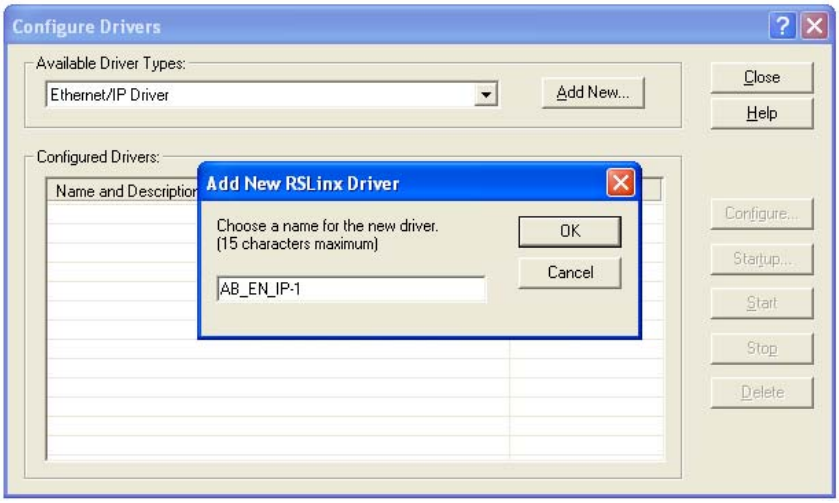
The following example explains the creation of a connection via the Allen Bradley EtherNet/IP interface.

The selection of the EtherNet/IP Driver module is done using the "Communications → Configure Drivers" command.

Select the driver type category "EtherNet/IP Driver".

Once the driver type has been selected, click the "Add new" button and choose a name for the new EtherNet/IP Driver.

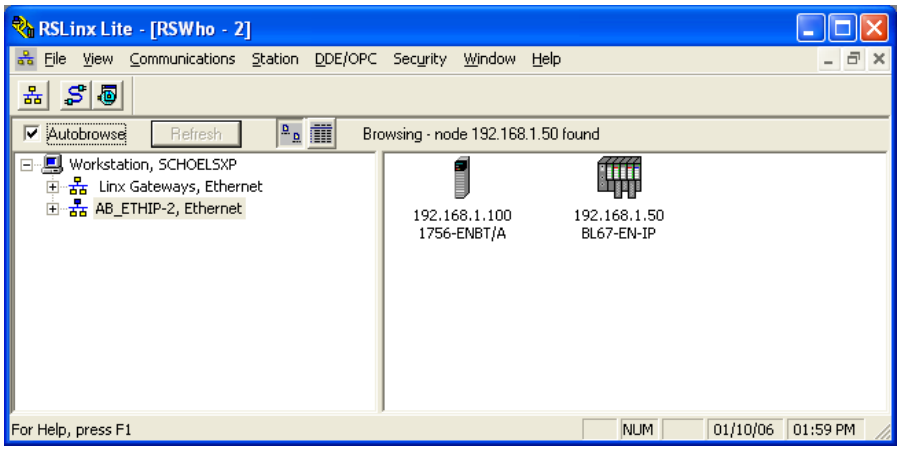
Figure 43: Selecting the EtherNet/IP Driver module



The connection to EtherNet/IP is established following successful configuration driver

In RSLinx, the "Autobrowse" function can be used to scan the network. All hosts in the network, which is defined by the settings of your network card, will be found.

Figure 44: Scanning the EtherNet/IP network via RSWho



6.6 Configuration of the network in "RSLogiX 5000"

The EtherNet/IP hosts (PLC, EtherNet/IP interface, I/O modules) have to be configured using the software "RSLogix 5000" (in this example version 15) from Rockwell Automation.

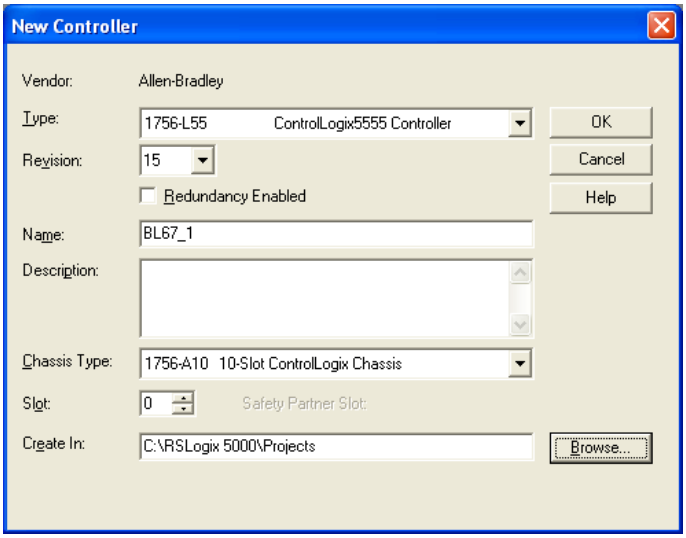
Start RSLogix and open a new project using the "File" menu.

Figure 45: Creating a new project in RSLogix

6.6.1 Configuration of the controller

Enter the information related to the controller depending on your configuration, as well as a name for the project.

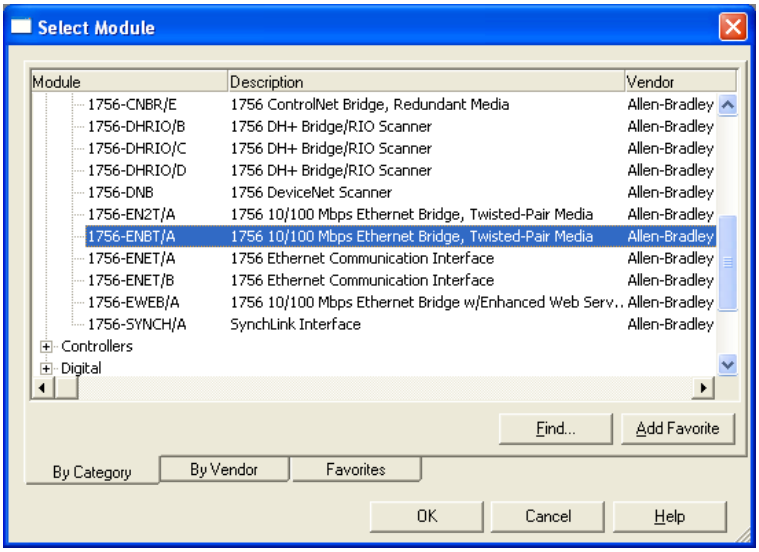
Figure 46: Configuration of the controller



Your project will be opened offline. In order to configure the network, please right-click "I/O Configuration" and select "new Module" to add the first host, the EtherNet/IP bridge, to the network.

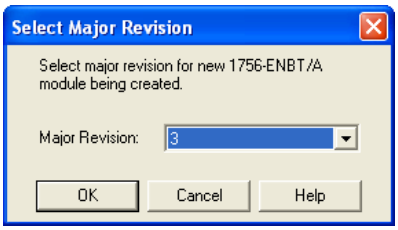
Open "Communications" and select the bridge. In this example this would be 1756-ENBT/A.

Figure 47: Selection of the EtherNet/IP bridge



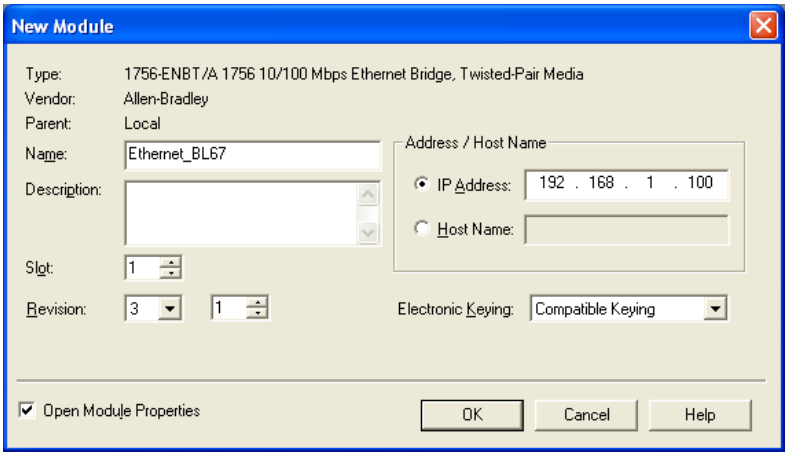
Enter the "Major Revision" of your EtherNet/IP bridge and click "OK".

Figure 48: Major Revision of the EtherNet/IP Bridge



In the following dialog box "New Module" enter the a name for the bridge and define its IP Address (in this example 192.168.1.100).

Figure 49: Configuring the EtherNet/IP Bridge



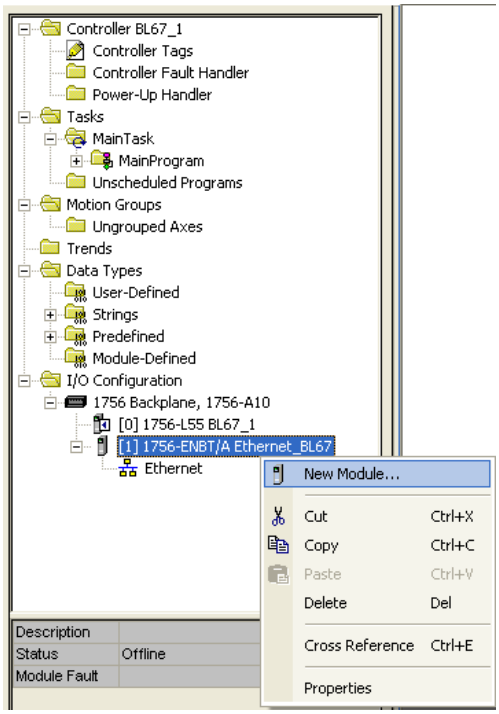
In the following dialog box "Module Properties: Local..." press "OK". You may also browse offline through the module properties when you click "Next". At this point there is no need for further entry action. If "Next" is selected, the "Module Properties" window displays information that will be available

when the module is online. The configuration of the interface is completed. Press "Finish" to close the dialog box.

6.6.2 Configuration of a BL67 station

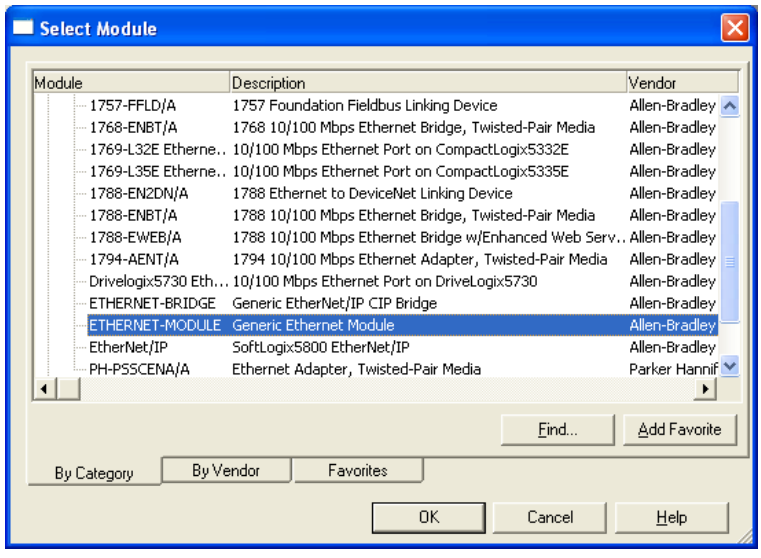
Add the BL67 to the I/O configuration by using a right-click on the EtherNet/IP bridge module 1756-ENBT/A and select "New Module".

Figure 50: Adding the BL67 station to the I/O configuration



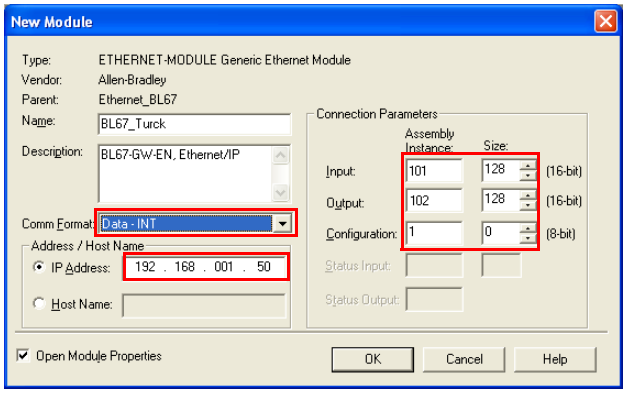
Open "Communications" and select the entry "Generic Ethernet Module" to configure a BL67 gateway.

Figure 51: Add generic Ethernet module


Select Module
Module
Description
Vendor
1757-FFLD/A 1757 Foundation Fieldbus Linking Device Allen-Bradley
1768-ENBT/A 1768 10/100 Mbps Ethernet Bridge, Twisted-Pair Media Allen-Bradley
1769-L32E Etherne.. 10/100 Mbps Ethernet Port on CompactLogix5332E Allen-Bradley
1769-L35E Etherne.. 10/100 Mbps Ethernet Port on CompactLogix5335E Allen-Bradley
1788-EN2DN/A 1788 Ethernet to DeviceNet Linking Device Allen-Bradley
1788-ENBT/A 1788 10/100 Mbps Ethernet Bridge, Twisted-Pair Media Allen-Bradley
1788-EWEB/A 1788 10/100 Mbps Ethernet Bridge w/Enhanced Web Serv.. Allen-Bradley
1794-AENT/A 1794 10/100 Mbps Ethernet Adapter, Twisted-Pair Media Allen-Bradley
Drivelogix5730 Eth... 10/100 Mbps Ethernet Port on DriveLogix5730 Allen-Bradley
ETHERNET-BRIDGE Generic EtherNet/IP CIP Bridge Allen-Bradley
ETHERNET-MODULE Generic Ethernet Module Allen-Bradley
EtherNet/IP SoftLogix5800 EtherNet/IP Allen-Bradley
PH-PSSCENA/A Ethernet Adapter, Twisted-Pair Media Parker Hannif
Find...
Add Favorite
By Category
By Vendor
Favorites
OK
Cancel
Help

For the Assembly Instances 101 and 102, the Connection Parameters (input and output size = 256 Byte each) are static and have to be set as follows:

Figure 52: Configuration of BL67 gateway

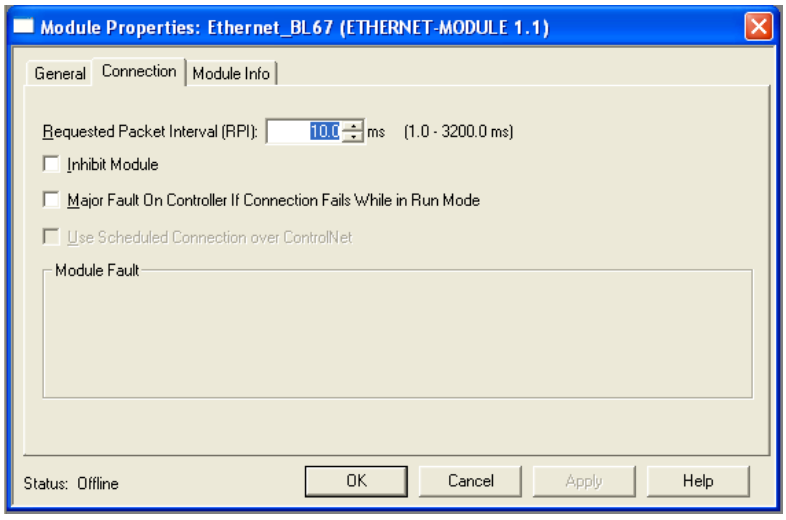


Note

If the variable Assembly Instances 103 and 104 (see page 5-12) are used, the Connection Parameters have to be set according to the actual station configuration which means, the in- and output sizes have to match the sizes definitely required by the station. This required in- and output size (2 to max. 496 Byte) can be read out using Assembly Class (0×04), Instance 0×67, Attr. 0×04 and Assembly Class (0×04), Instance 0×68, Attr. 0×04.

In the "Connection" tab set the "Requested Packet Interval" (RPI) to 10 ms, which normally should be the default setting. For BL67, the successfully tested RPI range is 5 and higher.

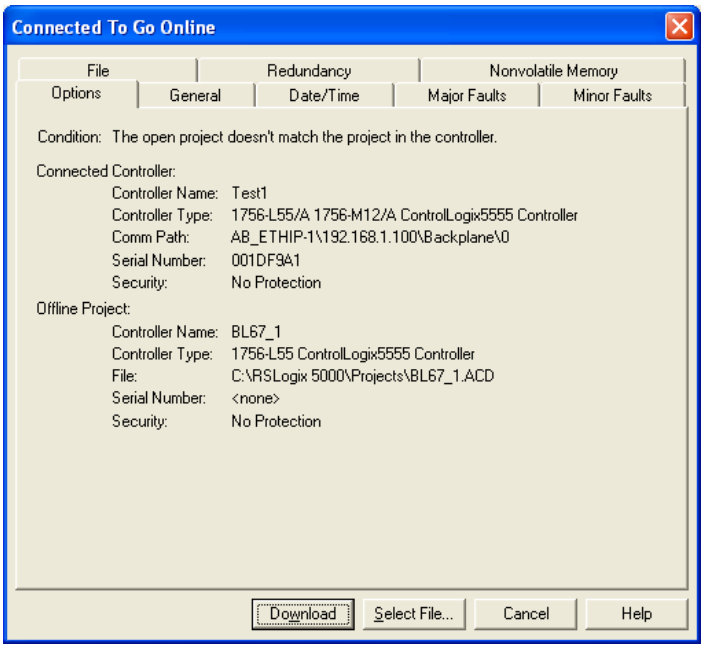
Figure 53: Set connection options for BL67



6.6.3 Downloading the I/O configuration

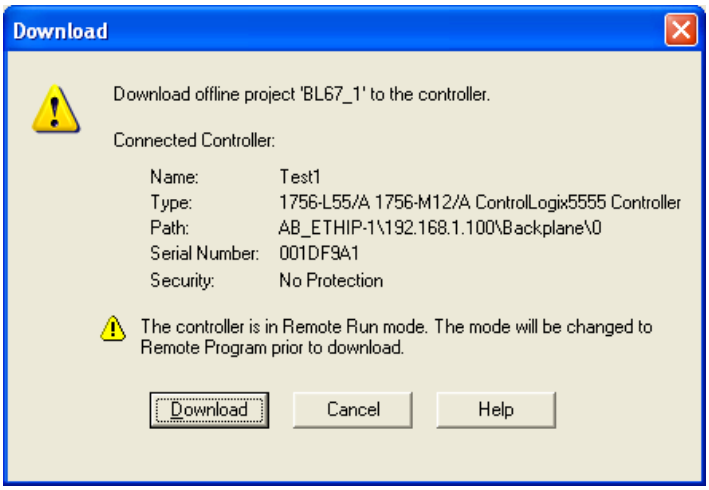
If the configuration of the network is completed, it can be downloaded to the controller by using for example the "Communication → Download" command.

Figure 54: Downloading the configuration



In the "Download" dialog box, start the download by pressing the "Download" button.

Figure 55: Downloading the configuration



If an error message is generated, warning, that the communication path can not be found, please open the "Path" menu (see Figure 57:), select your controller and press "Set Project Path" (see Figure 58:).

Figure 56: Error message

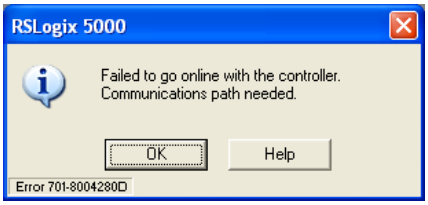


Figure 57: Communication Path

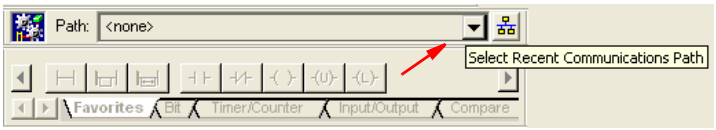
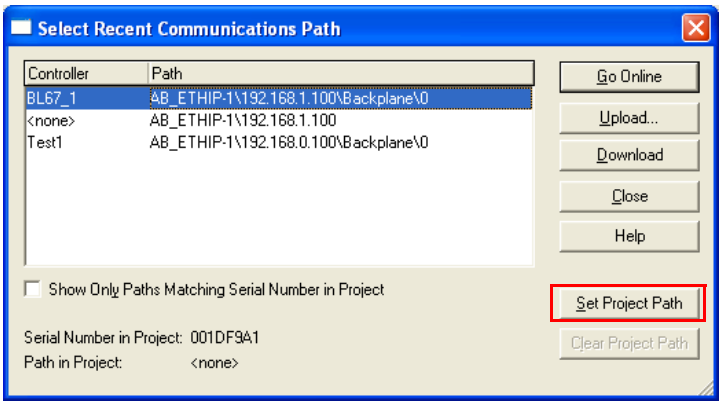


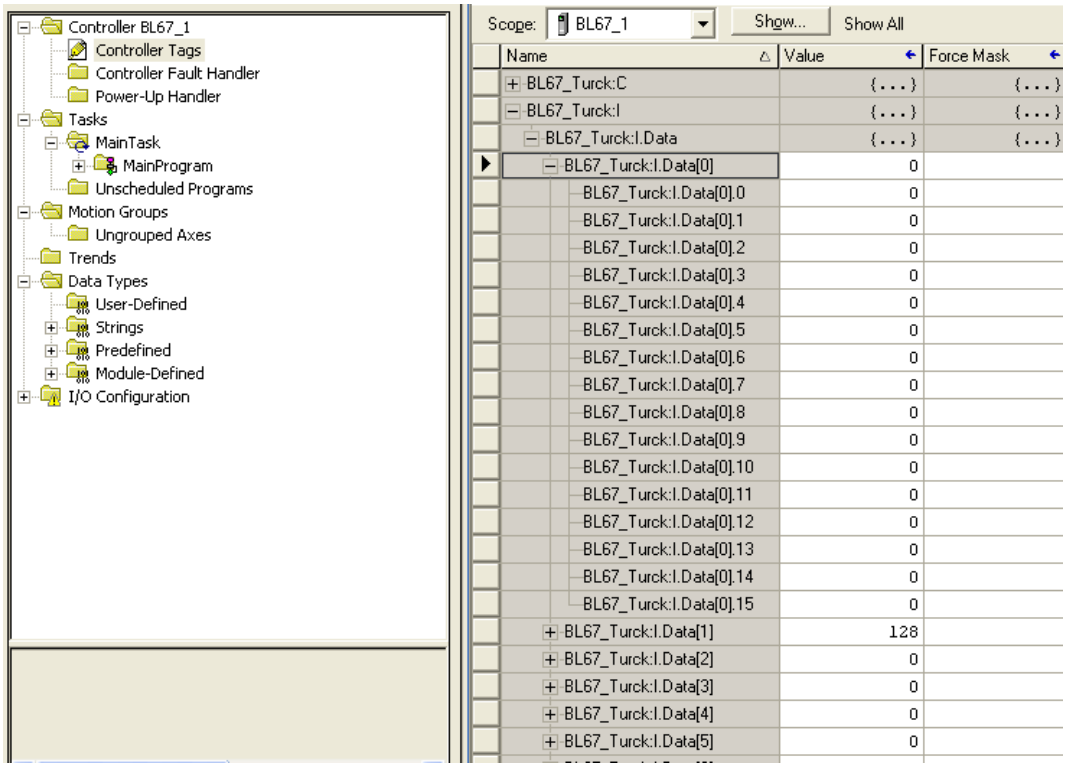
Figure 58: Communication Path



If the correct communication path is set, it is possible to download the configuration.

Once the I/O configuration is downloaded and the controller is in "Run" or "Remote Run" mode, the I/O-data mapping of the BL67 station is shown in the "Controller Tags":

Figure 59: Controller Tags



The controller tags for BL67 are divided into:

- BL67_Turck: C - the station's mapped configuration data
- BL67_Turck: I - the station's mapped input data
- BL67_Turck: O - the station's mapped output data

6.7 Examples for I/O data mapping

Each module is now accessible via the controller tags for viewing input data and/or forcing outputs.

The data mapping depends on the data width of each module connected to the gateway.

Table 63: Example station

Module		Data width	
		Process input	**Process output**
GW	BL67-GW-EN-IP	1 status word	1 control word
0	BL67-2AI-I	2 words	-
1	BL67-4DI-P	4 bits	-
2	BL67-8DI-PD	8 bits	-
3	BL67-2AI-TC	2 words	-
4	BL67-8XSG-PD	8 bits	8 bits
5	BL67-4DI-PD	4 bits	-
6	BL67-8DI-P	8 bits	-
7	BL67-8DO-0.5A-P	-	8 bits
8	BL67-2AO-V	-	2 words
9	BL67-2AI-I	2 words	-
10	BL67-1RS232	4 words	4 words

According to the I/O data widths of the modules in the example station (see Table 63: Example station), the I/O data mapping for the example station is the following:

Table 64: Data mapping for the example station

A *I.Data [0] = Byte 0 of mapped input data*

Module		I/O data word in RSLogix
GW	BL67-GW-EN-IP	– Input data: **A** BL67:**I.Data [0]**; Status Word
		– Output data: BL67:**O.Data [0]**; Command Word
0	BL67-2AI-I	– Input data: BL67:**I.Data [1]**; Channel 0 BL67:**I.Data [2]**; Channel 1
1	BL67-4DI-P	– Input data: BL67:**I.Data [3]**; Bits 0 to 3 for channels 0 to 3.
2	BL67-8DI-PD	– Input data: BL67:**I.Data [3]**; Bits 4 to 11 for channels 0 to 7.
3	BL67-2AI-TC	– Input data: BL67:**I.Data [4]**; Channel 0: BL67:**I.Data [5]**; Channel 1:
4	BL67-8XSG-PD	– Input data BL67:**I.Data [6]**; Bits 0 to 7 for channels 0 to 7.
		– Output data: BL67:**O.Data [1]**; Bits 0 to 7, for channels 0 to 7.
5	BL67-4DI-PD	– Input data BL67:**I.Data [6]**; Bits 8 to 11 for channels 0 to 3.

Module		I/O data word in RSLogix
6	BL67-8DI-P	– Input data BL67:**I.Data [6]**; Bits 12 to 15 for channels 0 to 3. BL67:**I.Data [7]**; Bits 0 to 3 for channels 4 to 7.
7	BL67-8DO-0.5A-P	– Output data: BL67:**O.Data [1]**; Bits 8 to 15, for channels 0 to 7.
8	BL67-2AO-V	– Output data: BL67:**O.Data [2]**; Channel 0 BL67:**O.Data [3]**; Channel 1
9	BL67-2AI-I	– Input data: BL67:**I.Data [8]**; Channel 0 BL67:**I.Data [9]**; Channel 1
10	BL67-1RS232	– Input data: BL67:**I.Data [10 - 13]**
		– Output data: BL67:**O.Data [4 - 7]**

6.7.1 Mapping report via I/O-ASSISTANT

An EtherNet/IP I/O mapping report can be generated for each individual station by means of the software tool I/O-ASSISTANT.

Figure 60: I/O mapping report in software tool I/O-ASSISTANT

6. EtherNet/IP report

6.1. Station description

Station address: 192.168.124.1

Adr./Slot	Name	TAG	Descr.	Data Size In	Data Size Out
Slot 0*	BL67-GW-EN-IP	192.168.124.1/-	Term0A	16 bit	16 bit
Slot 1	BL67-2AI-I	-/-	Term0B	32 bit	0 bit
Slot 2	BL67-4DI-P	-/-	Term0C	4 bit	0 bit
Slot 3	BL67-8DI-PD	-/-	Term0D	8 bit	0 bit
Slot 4	BL67-2AI-TC	-/-	Term0E	32 bit	0 bit
Slot 5	BL67-8XSG-PD	-/-	Term0F	8 bit	8 bit
Slot 6	BL67-4DI-PD	-/-	Term0G	4 bit	0 bit
Slot 7	BL67-8DI-P	-/-	Term0H	8 bit	0 bit
Slot 8	BL67-8DO-0.5A-P	-/-	Term0I	0 bit	8 bit
Slot 9	BL67-2AO-V	-/-	Term0J	0 bit	32 bit
Slot 10	BL67-2AI-I	-/-	Term0K	32 bit	0 bit
Slot 11	BL67-1RS232	-/-	Term0L	64 bit	64 bit
Total size for in/out data in bytes (rounded on full words)				**28**	**16**

*For detailed information about status/control word see online help

6.2. I/O map for input data

	Byte n+1								Byte n							
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word0*	0A.15	0A.14	0A.13	0A.12	0A.11	0A.10	0A.9	0A.8	0A.7	0A.6	0A.5	0A.4	0A.3	0A.2	0A.1	0A.0
Word1	0B.15	0B.14	0B.13	0B.12	0B.11	0B.10	0B.9	0B.8	0B.7	0B.6	0B.5	0B.4	0B.3	0B.2	0B.1	0B.0
Word2	0B.31	0B.30	0B.29	0B.28	0B.27	0B.26	0B.25	0B.24	0B.23	0B.22	0B.21	0B.20	0B.19	0B.18	0B.17	0B.16
Word3	-	-	-	-	0D.7	0D.6	0D.5	0D.4	0D.3	0D.2	0D.1	0D.0	0C.3	0C.2	0C.1	0C.0
Word4	0E.15	0E.14	0E.13	0E.12	0E.11	0E.10	0E.9	0E.8	0E.7	0E.6	0E.5	0E.4	0E.3	0E.2	0E.1	0E.0
Word5	0E.31	0E.30	0E.29	0E.28	0E.27	0E.26	0E.25	0E.24	0E.23	0E.22	0E.21	0E.20	0E.19	0E.18	0E.17	0E.16
Word6	-	-	-	-	0G.3	0G.2	0G.1	0G.0	0F.7	0F.6	0F.5	0F.4	0F.3	0F.2	0F.1	0F.0
Word7	-	-	-	-	-	-	-	-	0H.7	0H.6	0H.5	0H.4	0H.3	0H.2	0H.1	0H.0
Word8	0K.15	0K.14	0K.13	0K.12	0K.11	0K.10	0K.9	0K.8	0K.7	0K.6	0K.5	0K.4	0K.3	0K.2	0K.1	0K.0
Word9	0K.31	0K.30	0K.29	0K.28	0K.27	0K.26	0K.25	0K.24	0K.23	0K.22	0K.21	0K.20	0K.19	0K.18	0K.17	0K.16
Word10	0L.15	0L.14	0L.13	0L.12	0L.11	0L.10	0L.9	0L.8	0L.7	0L.6	0L.5	0L.4	0L.3	0L.2	0L.1	0L.0
Word11	0L.31	0L.30	0L.29	0L.28	0L.27	0L.26	0L.25	0L.24	0L.23	0L.22	0L.21	0L.20	0L.19	0L.18	0L.17	0L.16
Word12	0L.47	0L.46	0L.45	0L.44	0L.43	0L.42	0L.41	0L.40	0L.39	0L.38	0L.37	0L.36	0L.35	0L.34	0L.33	0L.32
Word13	0L.63	0L.62	0L.61	0L.60	0L.59	0L.58	0L.57	0L.56	0L.55	0L.54	0L.53	0L.52	0L.51	0L.50	0L.49	0L.48

*For detailed information about status/control word see online help

Process input data: 28 Byte

6.3. I/O map for output data

	Byte n+1								Byte n							
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word0*	0A.15	0A.14	0A.13	0A.12	0A.11	0A.10	0A.9	0A.8	0A.7	0A.6	0A.5	0A.4	0A.3	0A.2	0A.1	0A.0
Word1	0I.7	0I.6	0I.5	0I.4	0I.3	0I.2	0I.1	0I.0	0F.7	0F.6	0F.5	0F.4	0F.3	0F.2	0F.1	0F.0
Word2	0J.15	0J.14	0J.13	0J.12	0J.11	0J.10	0J.9	0J.8	0J.7	0J.6	0J.5	0J.4	0J.3	0J.2	0J.1	0J.0
Word3	0J.31	0J.30	0J.29	0J.28	0J.27	0J.26	0J.25	0J.24	0J.23	0J.22	0J.21	0J.20	0J.19	0J.18	0J.17	0J.16
Word4	0L.15	0L.14	0L.13	0L.12	0L.11	0L.10	0L.9	0L.8	0L.7	0L.6	0L.5	0L.4	0L.3	0L.2	0L.1	0L.0
Word5	0L.31	0L.30	0L.29	0L.28	0L.27	0L.26	0L.25	0L.24	0L.23	0L.22	0L.21	0L.20	0L.19	0L.18	0L.17	0L.16
Word6	0L.47	0L.46	0L.45	0L.44	0L.43	0L.42	0L.41	0L.40	0L.39	0L.38	0L.37	0L.36	0L.35	0L.34	0L.33	0L.32
Word7	0L.63	0L.62	0L.61	0L.60	0L.59	0L.58	0L.57	0L.56	0L.55	0L.54	0L.53	0L.52	0L.51	0L.50	0L.49	0L.48

*For detailed information about status/control word see online help

Process output data: 16 Byte

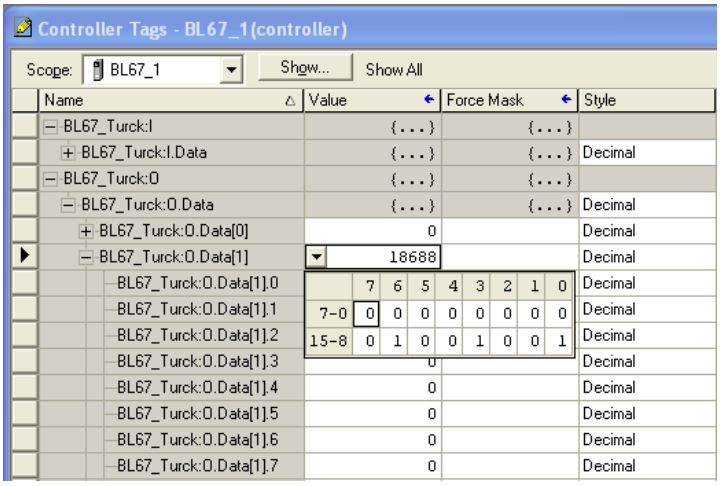
6.8 Example for process data access

6.8.1 Setting outputs at BL67-8DO-0.5A-P

Example:

To set the outputs "0", "3" and "6" at module no. 7 in the example station (BL67-8DO-0.5A-P), bit 8, bit 11 and bit 14 in output data word 1 (BL67:O.Data [1]) have to be set (see above Table 64: Data mapping for the example station).

Figure 61: Setting outputs at module no. 7



7 Guidelines for station planning

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7.1 Module arrangement

7.1.1 Random module arrangement

The arrangement of the I/O-modules within a BL67 station can basically be chosen at will.

Nevertheless, it can be useful with some applications to group certain modules together.

7.2 Complete planning

The planning of a BL67 station should be thorough to avoid faults and increase operating reliability.

Attention

If there are more than two empty slots next to one another, the communication is interrupted to all following BL67 modules.

7.3 Maximum system extension

A BL67 station can consist of a gateway and a maximum of 32 modules (equivalent to 1 m station length).

The following overview shows the maximum number of channels possible under these conditions:

- The entire station is made up of the respective channel type only.

Table 65: Maximum system extension

Module type	maximum number	
	Channels	Modules
BL67-4DI-P	128	32
BL67-8DI-P	256	32
BL67-4DO-xA-P	128	32
BL67-8DO-xA-P	256	32
BL67-16DO-0.1A-P	512	32
BL67-4DI4DO-PD	256	32
BL67-8XSG-PD	256	32
BL67-2AI-x	64	32
BL67-2AI-PT	64	32
BL67-2AI-TC	64	32
BL67-4AI-V/I	128	32
BL67-2AO-I	64	32
BL67-2AO-V	50 **A**	25 **A**
BL67-1RS232	10 **A**	10 **A**
BL67-1RS485/422	21 **A**	21 **A**
BL67-1SSI	26 **A**	26 **A**
BL67-1CVI	32	32

A *limited due to the high current consumption (max. 1,5 A) on the module bus (5 V)*

Attention

Ensure that a sufficient number of Power Feeding modules are used if the system is extended to its maximum.

Note

If the system limits are exceeded, the software I/O-ASSISTANT generates an error message when the user activates the command “Station → Verify“.

7.3.1 Creating potential groups

Power Feeding modules can be used to create potential groups. The potential isolation of potential groups to the left of the respective power distribution modules is provided by the base modules.

7.4 Plugging and pulling electronic modules

BL67 enables the pulling and plugging of electronic modules without having to disconnect the field wiring. The BL67 station remains in operation if an electronic module is pulled.
The voltage and current supplies as well as the protective earth connections are not interrupted.

Attention

If the field and system supplies remain connected when electronic modules are plugged or pulled, short interruptions to the module bus communications can occur in the BL67 station. This can lead to undefined statuses of individual inputs and outputs of different modules.

7.5 Extending an existing station

Attention

Please note that extensions to the station (mounting further modules) should be carried out only when the station is in a voltage-free state.

7.6 Firmware download

Firmware can be downloaded via the service interface on the gateway using the software tool I/O-ASSISTANT. More information is available in the program's online help.

Attention

The station should be disconnected from the fieldbus when downloading.

Firmware must be downloaded by authorized personnel only.

The field level must be isolated.

8 Guidelines for electrical installation

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8.1 General notes

8.1.1 General

Cables should be grouped together, for example: signal cables, data cables, heavy current cables, power supply cables.

Heavy current cables and signal or data cables should always be routed in separate cable ducts or bundles. Signal and data cables must always be routed as close as possible to ground potential surfaces (for example support bars, cabinet sides etc.).

8.1.2 Cable routing

Correct cable routing prevents or suppresses the reciprocal influencing of parallel routed cables.

8.1.3 Cable routing inside and outside of cabinets

To ensure EMC-compatible cable routing, the cables should be grouped as follows:

Various types of cables within the groups can be routed together in bundles or in cable ducts.

Group 1:

- shielded bus and data cables
- shielded analog cables
- unshielded cables for DC voltage ≤ 60 V
- unshielded cables for AC voltage ≤ 25 V

Group 2:

- unshielded cables for DC voltage > 60 V and ≤ 400 V
- unshielded cables for AC voltage > 25 V and ≤ 400 V

Group 3:

- unshielded cables for DC and AC voltages > 400 V

The following group combination can be routed only in separate bundles or separate cable ducts (no minimum distance apart):

- **Group 1/group 2**

The group combinations:

- **Group 1/group 3 and group 2/group 3**

must be routed in separate cable ducts with a minimum distance of 10 cm apart. This is equally valid for inside buildings as well as for inside and outside of switchgear cabinets.

Cable routing outside buildings

Outside of buildings, cables should be routed in closed (where possible), cage-type cable ducts made of metal. The cable duct joints must be electrically connected and the cable ducts must be earthed.

Danger

Observe all valid guidelines concerning internal and external lightning protection and grounding specifications when routing cables outside of buildings.

8.1.4 Lightning protection

The cables must be routed in double-grounded metal piping or in reinforced concrete cable ducts.

Signal cables must be protected against overvoltage by varistors or inert-gas filled overvoltage arrestors. Varistors and overvoltage arrestors must be installed at the point where the cables enter the building.

8.1.5 Transmission media

For a communication via Ethernet, different transmission media can be used:

- coaxial cable (10Base5)
- optical fibre (10BaseF)
- twisted two-wire cable (10BaseT) with shielding (STP) or without shielding (UTP).

Note

Turck offers a variety of cable types for fieldbus lines as premoulded or bulk cables with different connectors.

The ordering information for the available cable types can be found in the BL67 catalog.

8.2 Potential relationships

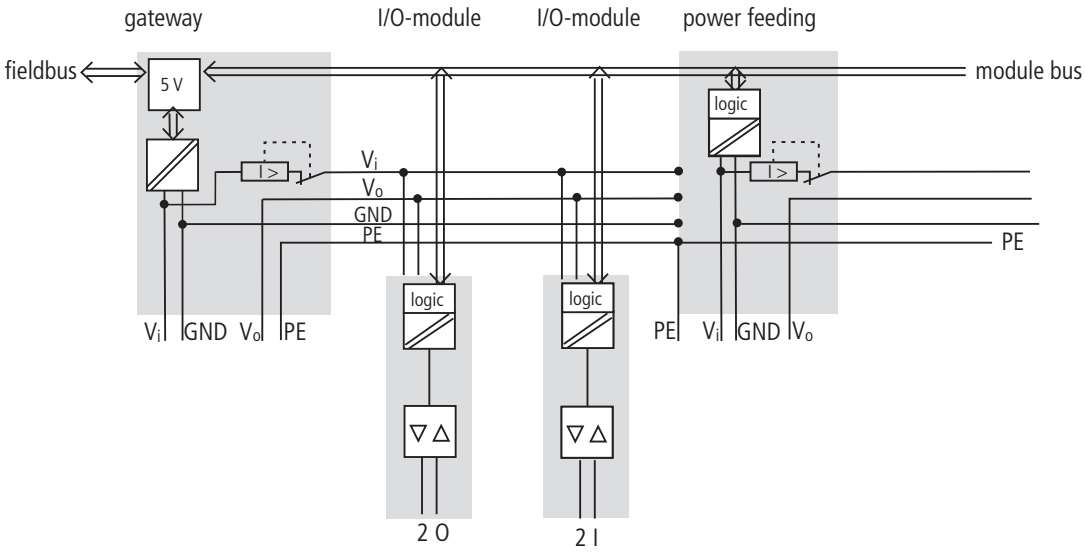
8.2.1 General

The potential relationship of a EtherNet/IP system realized with BL67 modules is characterized by the following:

- The system supply of gateway and I/O-modules as well as the field supply are realized via one power feed at the gateway.
- All BL67 modules (gateway, Power Feeding and I/O-modules), are connected capacitively via base modules to the mounting rails.

The block diagram shows the arrangement of a typical BL67 station.

Figure 62: Block diagram of a BL67 station



8.3 Electromagnetic compatibility (EMC)

BL67 products comply in full with the requirements pertaining to EMC regulations.

Nevertheless, an EMC plan should be made before installation. Hereby, all potential electromechanical sources of interference should be considered such as galvanic, inductive and capacitive couplings as well as radiation couplings.

8.3.1 Ensuring Electromagnetic Compatibility

The EMC of BL67 modules is guaranteed when the following basic rules are adhered to:

- Correct and large surface grounding of inactive metal components.
- Correct shielding of cables and devices.
- Proper cable routing – correct wiring.
- Creation of a standard reference potential and grounding of all electrically operated devices.
- Special EMC measures for special applications.

8.3.2 Grounding of inactive metal components

All inactive metal components (for example: switchgear cabinets, switchgear cabinet doors, supporting bars, mounting plates, tophat rails, etc.) must be connected to one another over a large surface area and with a low impedance (grounding). This guarantees a standardized reference potential area for all control elements and reduces the influence of coupled disturbances.

- In the areas of screw connections, the painted, anodized or isolated metal components must be freed of the isolating layer. Protect the points of contact against rust.
- Connect all free moving groundable components (cabinet doors, separate mounting plates, etc.) by using short bonding straps to large surface areas.
- Avoid the use of aluminum components, as its quick oxidizing properties make it unsuitable for grounding.

Danger

The grounding must never – including cases of error – take on a dangerous touch potential. For this reason, always protect the ground potential with a protective cable.

8.3.3 PE connection

A central connection must be established between ground and PE connection (protective earth).

8.3.4 Earth-free operation

Observe all relevant safety regulations when operating an earthfree system.

8.3.5 Mounting rails

All mounting rails must be mounted onto the mounting plate with a low impedance, over a large surface area, and must be correctly earthed.

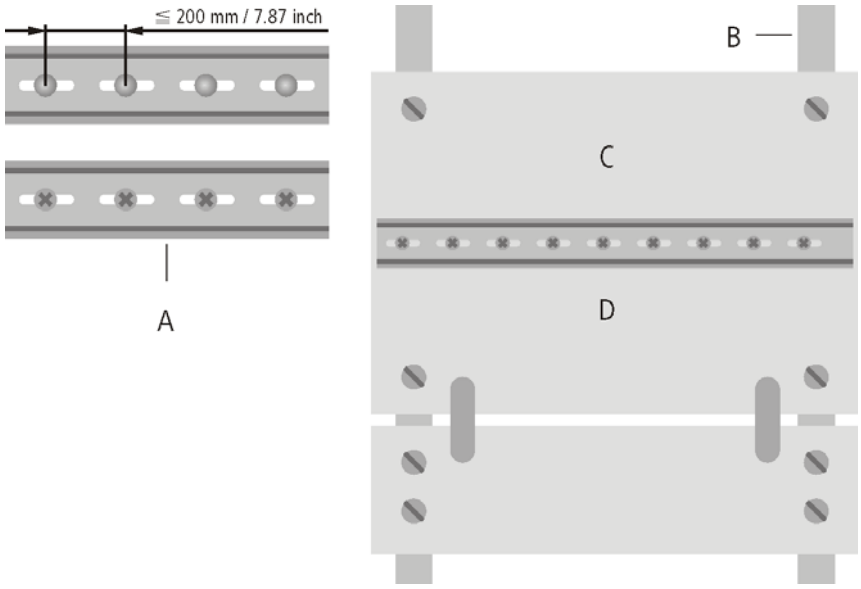


Figure 63: Mounting options

A *TS 35*
B *Mounting rail*
C *Mounting plate*
D *TS 35*

Mount the mounting rails over a large surface area and with a low impedance to the support system using screws or rivets.

Remove the isolating layer from all painted, anodized or isolated metal components at the connection point. Protect the connection point against corrosion (for example with grease; caution: use only suitable grease).

8.4 Shielding of cables

Shielding is used to prevent interference from voltages and the radiation of interference fields by cables. Therefore, use only shielded cables with shielding braids made from good conducting materials (copper or aluminum) with a minimum degree of coverage of 80 %.

The cable shield should always be connected to both sides of the respective reference potential (if no exception is made, for example, such as high-resistant, symmetrical, analog signal cables). Only then can the cable shield attain the best results possible against electrical and magnetic fields.

A one-sided shield connection merely achieves an isolation against electrical fields.

Attention

When installing, please pay attention to the following...

– the shield should be connected immediately when entering the
– system,
– the shield connection to the shield rail should be of low
– impedance,
– the stripped cable-ends are to be kept as short as possible,
– the cable shield is not to be used as a bonding conductor.

If the data cable is connected via a SUB-D connector, the shielding should never be connected via pin 1, but to the mass collar of the plug-in connector.

The insulation of the shielded data-cable should be stripped and connected to the shield rail when the system is not in operation. The connection and securing of the shield should be made using metal shield clamps. The shield clamps must enclose the shielding braid and in so doing create a large surface contact area. The shield rail must have a low impedance (for example, fixing points of 10 to 20 cm apart) and be connected to a reference potential area.

The cable shield should not be severed, but routed further within the system (for example, to the switchgear cabinet), right up to the interface connection.

Note

Should it not be possible to ground the shield on both sides due to switching arrangements or device specific reasons, then it is possible to route the second cable shield side to the local reference potential via a capacitor (short connection distances). If necessary, a varistor or resistor can be connected parallel to the capacitor, to prevent disruptive discharges when interference pulses occur.

A further possibility is a double-shielded cable (galvanically separated), whereby the innermost shield is connected on one side and the outermost shield is connected on both sides.

8.5 Potential compensation

Potential differences can occur between installation components that are in separate areas and these

- are fed by different supplies,
- have double-sided conductor shields which are grounded on different installation components.

A potential-compensation cable must be routed to the potential compensation.

Danger

Never use the shield as a potential compensation.

A potential compensation cable must have the following characteristics:

- Low impedance. In the case of compensation cables that are routed on both sides, the compensation line impedance must be considerably smaller than that of the shield connection (max. 10 % of shield connection impedance).
- Should the length of the compensation cable be less than 200 m, then its cross-section must be at least 16 mm^2 / 0.025 $inch^2$. If the cable length is greater than 200 m, then a cross-section of at least 25 mm^2 / 0.039 $inch^2$ is required.
- The compensation cable must be made of copper or zinc coated steel.
- The compensation cable must be connected to the protective conductor over a large surface area and must be protected against corrosion.
- Compensation cables and data cables should be routed as close together as possible, meaning the enclosed area should be kept as small as possible.

8.5.1 Switching inductive loads

In the case of inductive loads, a protective circuit on the load is recommended.

8.5.2 Protection against Electrostatic Discharge (ESD

Attention

Electronic modules and base modules are at risk from electrostatic discharge when disassembled. Avoid touching the bus connections with bare fingers as this can lead to ESD damage.

9 Appendix

9.1 Nominal current consumption of modules at Ethernet 2

9.1 Nominal current consumption of modules at Ethernet

Table 66: nominal current consumptions of the modules at Ethernet

Module	Current consumptions on 24 V DC
BL67-GW-EN-IP	
Power supply modules	
BL67-PF-24VDC	≤ 9 mA
Digital input modules	
BL67-4DI-P	≤ 9 mA
BL67-8DI-P	≤ 9 mA
BL67-4DI-PD	≤ 35 mA
BL67-8DI-PD	≤ 35 mA
BL67-4DI-N	≤ 8 mA
BL67-8DI-N	≤ 8 mA
Analog input modules	
BL67-2AI-I	≤ 10 mA
BL67-2AI-V	≤ 10 mA
BL67-2AI-PT	≤ 13 mA
BL67-2AI-TC	≤ 10 mA
Digital output modules	
BL67-4DO-0.5A-P	≤ 9 mA
BL67-4DO-2A-P	≤ 9 mA
BL67-8DO-0.5A-P	≤ 9 mA
BL67-4DO-2A-N	≤ 24 mA
BL67-8DO-0.5A-N	≤ 24 mA
BL67-16DO-0.1A-P	≤ 9 mA
Analog output modules	
BL67-2AO-I	≤ 12 mA
BL67-2AO-V	≤ 17 mA
Digital combi modules	
BL67-4DI/4DO-PD	≤ 35 mA
BL867-8XSG-PD	≤ 35 mA

Table 66: nominal current consumptions of the modules at Ethernet

Module	Current consumptions on 24 V DC
Technology modules	
BL67-1RS232	≤ 28 mA
BL67-1RS485/422	≤ 20 mA
BL67-1SSI	≤ 32 mA
BL67-1CVI	≤ 24 mA

Note

Please find any information about the bus-independent, module specific current consumptions in the manual "BL67- I/O-modules" (TURCK-Documentation No.: German D300572/ English D300527).

10 Glossary

A

Acknowledge

Acknowledgment of a signal received.

Active metal component

Conductor or conducting component that is electrically live during operation.

Address

Identification number of, e.g. a memory position, a system or a module within a network.

Addressing

Allocation or setting of an address, e. g. for a module in a network.

ARP

Used to definitely allocate the hardware addresses (MAC-IDs) assigned worldwide to the IP addresses of the network clients via internal tables.

Analog

Infinitely variable value, e. g. voltage. The value of an analog signal can take on any value, within certain limits.

Automation device

A device connected to a technical process with inputs and outputs for control. Programmable logic controllers (PLC) are a special group of automation devices.

B

Baud

Baud is a measure for the transmission speed of data. 1 Baud corresponds to the transmission of one bit per second (bit/s).

Baud rate

Unit of measurement for measuring data transmission speeds in bit/s.

Bidirectional

Working in both directions.

Bonding strap

Flexible conductor, normally braided, that joins inactive components, e. g. the door of a switchgear cabinet to the cabinet main body.

Bus

Bus system for data exchange, e. g. between CPU, memory and I/O levels. A bus can consist of several parallel cables for data transmission, addressing, control and power supply.

Bus cycle time

Time required for a master to serve all slaves or stations in a bus system, i. e. reading inputs and writing outputs.

Bus line

Smallest unit connected to a bus, consisting of a PLC, a coupling element for modules on the bus and a module.

Bus system

All units which communicate with one another via a bus.

C

Capacitive coupling

Electrical capacitive couplings occur between cables with different potentials. Typical sources of interference are, for example, parallel-routed signal cables, contactors and electrostatic discharges.

Check-back interface

The check-back interface is the interface from the counter module to the internal module bus. The bits and bytes are converted by the gateway from the respective type of communication applicable to the fieldbus in to the module-specific bits and bytes.

Coding elements

Two-piece element for the unambiguous assignment of electronic and base modules.

Configuration

Systematic arrangement of the I/O-modules of a station.

Control interface

The control interface is the interface from the internal module bus to the counter module. The commands and signals directed to the counter module are converted by the gateway from the respective type of communication applicable to the fieldbus in to the module-specific bits and bytes.

CPU

Central Processing Unit. Central unit for electronic data processing, the processing core of the PC.

D

DHCP

Client-Server-protocol which reduces the effort of assigning IP addresses or other parameters. Serves for dynamic and automatic configuration of devices.

Digital

A value (e. g. a voltage) which can adopt only certain statuses within a finite set, mostly defined as 0 and 1.

DIN

German acronym for German Industrial Standard.

E

EDS

Electronic Device Data Sheet which contains standardized DeviceNet station descriptions. They simplify the planning of the DeviceNet nodes.

EIA

Electronic Industries Association – association of electrical companies in the United States.

Electrical components

All objects that produce, convert, transmit, distribute or utilize electrical power (e. g. conductors, cable, machines, control devices).

EMC

Electromagnetic compatibility – the ability of an electrical part to operate in a specific environment without fault and without exerting a negative influence on its environment.

EN

German acronym for European Standard.

ESD

Electrostatic Discharge.

F

Field power supply

Voltage supply for devices in the field as well as the signal voltage.

Fieldbus

Data network on sensor/actuator level. A fieldbus connects the equipment on the field level. Characteristics of a fieldbus are a high transmission security and real-time behavior.

Force Mode

Software mode which enables the user to set his plant to a required state by forcing certain variables on the input and output modules.

G

GND

Abbreviation of ground (potential "0").

Ground

Expression used in electrical engineering to describe an area whose electrical potential is equal to zero at any given point. In neutral grounding devices, the potential is not necessarily zero, and one speaks of the ground reference.

Ground connection

One or more components that have a good and direct contact to earth.

Ground reference

Potential of ground in a neutral grounding device. Unlike earth whose potential is always zero, it may have a potential other than zero.

H

Hexadecimal

System of representing numbers in base 16 with the digits 0... 9, and further with the letters A, B, C, D, E and F.

Hysteresis

A sensor can get caught up at a certain point, and then "waver" at this position. This condition results in the counter content fluctuating around a given value. Should a reference value be within this fluctuating range, then the relevant output would be turned on and off in rhythm with the fluctuating signal.

I

I/O

Input/output.

Impedance

Total effective resistance that a component or circuit has for an alternating current at a specific frequency.

Inactive metal components

Conductive components that cannot be touched and are electrically isolated from active metal components by insulation, but can adopt voltage in the event of a fault.

Inductive coupling

Magnetic inductive couplings occur between two cables through which an electrical current is flowing. The magnetic effect caused by the electrical currents induces an interference voltage. Typical sources of interference are for example, transformers, motors, parallel-routed network and HF signal cables.

Intelligent modules

Intelligent modules are modules with an internal memory, able to transmit certain commands (e. g. substitute values and others).

IP

Abbreviation for Internet-Protocol, protocol for the packet-oriented and connectionless transport of data packets from a transmitter to a receiver crossing different networks.

L

Lightning protection

All measures taken to protect a system from damage due to overvoltages caused by lightning strike.

Low impedance connection

Connection with a low AC impedance.

LSB

Least Significant bit

M

Mass

All interconnected inactive components that do not take on a dangerous touch potential in the case of a fault.

Master

Station in a bus system that controls the communication between the other stations.

Module bus

The module bus is the internal bus in a station. The modules communicate with the gateway via the module bus which is independent of the fieldbus.

MSB

Most Significant bit

P

Ping

Implementation of an echo-protocol, used for testing whether a particular host is operating properly and is reachable on the network from the testing host.

PLC

Programmable Logic Controller.

Potential compensation

The alignment of electrical levels of electrical components and external conductive components by means of an electrical connection.

Potential free

Galvanic isolation of the reference potentials in I/O-modules of the control and load circuits.

Potential linked

Electrical connection of the reference potentials in I/O-modules of the control and load circuits.

Protective earth

Electrical conductor for protection against dangerous shock currents. Generally represented by PE (protective earth).

R

Radiation coupling

A radiation coupling appears when an electromagnetic wave hits a conductive structure. Voltages and currents are induced by the collision. Typical sources of interference are for example, sparking gaps (spark plugs, commutators from electric motors) and transmitters (e. g. radio), that are operated near to conducting structures.

Reaction time

The time required in a bus system between a reading operation being sent and the receipt of an answer. It is the time required by an input module to change a signal at its input until the signal is sent to the bus system.

Reference potential

Potential from which all voltages of connected circuits are viewed and/or measured.

Repeater

Amplifier for signals transmitted via a bus.

Root-connecting

Creating a new potential group using a power distribution module. This allows sensors and loads to be supplied individually.

RS 485

Serial interface in accordance with EIA standards, for fast data transmission via multiple transmitters.

S

Serial

Type of information transmission, by which data is transmitted bit by bit via a cable.

Setting parameters

Setting parameters of individual stations on the bus and their modules in the configuration software of the master.

Shield

Conductive screen of cables, enclosures and cabinets.

Shielding

Description of all measures and devices used to join installation components to the shield.

Short-circuit proof

Characteristic of electrical components. A short-circuit proof part withstands thermal and dynamic loads which can occur at its place of installation due to a short circuit.

Station

A functional unit or I/O components consisting of a number of elements.

T

TCP

Abbreviation for Transmission Control Protocol, connection-oriented transport protocol within the Internet protocol suite. Certain error detection mechanisms (i.e. acknowledgements, time-out monitoring) can guarantee a safe and error free data transport.

Terminating resistance

Resistor on both ends of a bus cable used to prevent interfering signal reflections and which provides bus cable matching. Terminating resistors must always be the last component at the end of a bus segment.

To ground

Connection of a conductive component with the grounding connection via a grounding installation.

Topology

Geometrical structure of a network or the circuitry arrangement.

U

UDP

Abbreviation for User Datagram Protocol. UDP is an transport protocol for the connectionless data between Ethernet hosts.

Unidirectional

Working in one direction.

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